28.D.91.

BOSTON

MEDICAL LIBRARY

8 THE FENWAY

DEFECTS

OF

SIGHT AND HEARING;

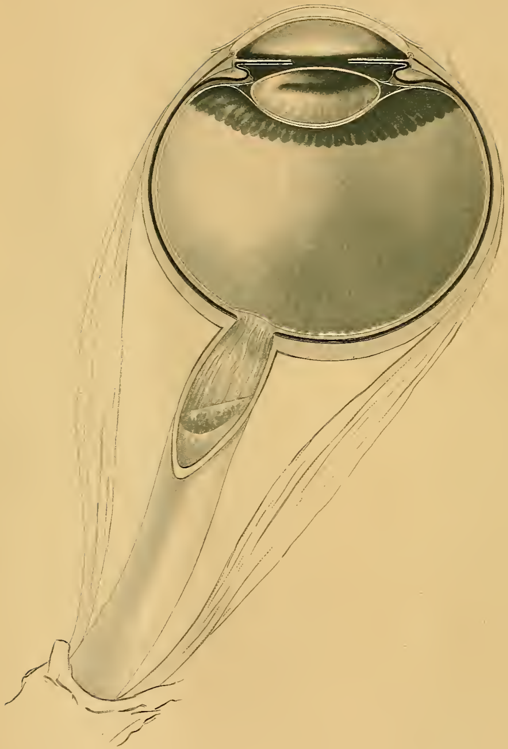
THEIR NATURE, CAUSES, PREVENTION,

AND

GENERAL MANAGEMENT.

Digitized by the Internet Archive
in 2012 with funding from
Open Knowledge Commons and Harvard Medical School

http://www.archive.org/details/defectsofsighthe00jone



Horizontal section of the right human eyeball.

H. Adlard sc.

62

DEFECTS

OF

SIGHT AND HEARING;

THEIR NATURE, CAUSES, PREVENTION,

AND

GENERAL MANAGEMENT.

BY

T. WHARTON JONES, F.R.S., F.R.C.S.,

PROFESSOR OF OPHTHALMIC MEDICINE AND SURGERY IN UNIVERSITY COLLEGE,
LONDON; OPHTHALMIC SURGEON TO THE HOSPITAL; LATE FULLERIAN
PROFESSOR OF PHYSIOLOGY IN THE ROYAL INSTITUTION OF
GREAT BRITAIN, &c.

SECOND EDITION OF 'DEFECTS OF SIGHT.'

LONDON:
JOHN CHURCHILL AND SONS,
NEW BURLINGTON STREET.
MDCCCLXVI.

BOSTON MEDICAL
JUL 18 1907
LIBRARY

1866

25. L. 71

J. E. ADLARD, PRINTER, BARTHOLOMEW CLOSE.

ADVERTISEMENT

TO

THE SECOND EDITION.

In the hope of rendering the work more generally useful, I have annexed to this second edition of 'Defects of Sight,' a few chapters on 'Defects of Hearing,' compiled from my writings on the subject.

A similar plan of combining the consideration of the defects of the two great senses has already been adopted with advantage in the American reprint of my book by its judicious editor.

T. WHARTON JONES.

35, George Street, Hanover Square,
London, W.; *May* 1*st*, 1866.

ADVERTISEMENT

TO

THE FIRST EDITION.

Much of the mortality which figures in the Registrar-General's Reports, it has been shown, might be prevented by attention to sanitary measures. In like manner much of the defective sight and blindness which we meet with is the result of disease, either preventible altogether, or at least curable if taken in time.

Impressed with this fact, it has occurred to me that a small volume containing some guiding principles relative to the care and preservation of the sight would be useful. Accordingly, I have thrown together, in the following pages, such observations on the subject as appear to me calculated to answer the end in view.

THE AUTHOR.

35, George Street, Hanover Square,
London; *August* 1*st*, 1856.

CONTENTS.

PART I.

DEFECTS OF SIGHT.

CHAPTER I.

NATURE OF THE SENSE OF SIGHT AND STRUCTURE OF THE EYES.

PAGE
Vital Energy of the Optic Nervous Apparatus ... 3
Structure of the Eyeball 4
Projection of Images on the Retina 8

CHAPTER II.

DEFECTS OF SIGHT REQUIRING THE USE OF SPECTACLES, AND ON THE SELECTION OF THE APPROPRIATE GLASSES IN EACH PARTICULAR CASE.

Refraction by Convergent Lenses, and the Adjustment of the Eye to different Distances 14
The Change in the Condition of the Eye on which Adjustment depends 17
Differences in the Length of Sight of different Persons 17
Range of Adjustment 20

PAGE
Test Letters for ascertaining the degree of Distinctness of Sight 22
Myopy, or Near-sightedness 24
Hypermetropy, or Over-sightedness 34
Presbyopy, or Old-sightedness 40
in the Emmetropic Eye 41
in the Myopic Eye 46
in the Hypermetropic Eye 46
Mydriasis, or simple fixed Dilatation of the Pupil, and Paralysis of Adjustment 47
Asthenopy, or Weak-sightedness 49
Uniocular Polyopy, or Manifold Vision with one Eye ... 52
Unequal Power of the two Eyes 52
Conical Cornea 54
Astigmatism, or Cylindrical Eye 54
Convex and Concave Spectacle Glasses 56
Cylindrical Lenses 57
Prismatic Glasses 58

CHAPTER III.

CATARACT.

Hard or common Lenticular Cataract of Old Persons ... 61
Removal of the Cataract by Extraction 63
Removal of Cataract by Division 66
Secondary Cataract 67
Can Cataract be cured without an Operation? ... 68
Cataract Glasses 68

CHAPTER IV.

MUSCÆ VOLITANTES, OR APPEARANCES LIKE MOTES OR FLIES FLOATING BEFORE THE SIGHT 70

CHAPTER V.

AMAUROTIC AFFECTIONS, OR DEFECTS OF SIGHT DEPENDING ON PERVERTED, IMPAIRED, OR LOST SENSIBILITY OF THE OPTIC NERVOUS APPARATUS.

PAGE
Abnormal Excitement of Visual Sensations 74
Photopsy and Chroopsy, or Sensations of Light and Colour, independently of External Light 74
Spectra from the Retention of Visual Sensations.—Complementary Colours 78
Phantasms 80
Impairment and Loss of Sensibility of the Optic Nervous Apparatus, or Amaurosis in its various degrees ... 83
Daltonism, or Colour Blindness 84
Transient Hemiopy, or Half-vision 85
Night-blindness 86
Amaurosis 88
Glaucoma 89

CHAPTER VI.

DEFECTS OF SIGHT DEPENDING ON LOSS OF CORRESPONDENCE OF THE SENSATIONS AND MOVEMENTS OF THE TWO EYES.

Single Vision with two Eyes 91
Visual Perception of the three Dimensions of Space, Length, Breadth, and Thickness 92
Diplopy, or Double Vision with two Eyes 93
Paralysis of the Muscles of the Eyeball and Eyelids ... 94
Strabismus, or Squint 95

CHAPTER VII.

CHOICE OF LIGHT FOR WORKING BY, THE USE OF EYE-SHADES, AND GENERAL PRECAUTIONS TO BE OBSERVED IN THE EMPLOYMENT OF THE SIGHT.

PAGE
Choice of Light 98
The use of Shades, Tinted Glasses, &c. 101
Care in the Employment of the Sight 102

CHAPTER VIII.

GENERAL PRECAUTIONS TO BE OBSERVED IN CASES OF INFLAMMATION, INJURIES, ETC., OF THE EYES, AND IN THE USE OF EYE-WATERS, ETC.

Ophthalmia, or Inflammation of the Eyes 105
Injuries of the Eye 107
Use and abuse of Eye-waters, Salves, and Warm and Cold Applications to the Eyes 108

CHAPTER IX.

PREVENTION AND MANAGEMENT OF THE DISEASES OF THE EYES LIABLE TO OCCUR AT THE DIFFERENT PERIODS OF LIFE.

Early Infancy, or Period at and from Birth up to Teething 111
Infancy and Childhood, or Period from the commencement of Teething up to about the Eighth Year 118
Youth and Adolescence 121
Adult Age 124
Turn of Life 126
Old Age 127

CHAPTER X.

CARE OF THE EYES IN CERTAIN GENERAL DISEASES, ETC.

PAGE
Care of the Eyes in Measles, Smallpox, Scarlet-fever, Hooping-cough 129
Care of the Eyes after Fevers 130
in Childbed and Suckling ... 131
in Venereal Diseases 131
Prevention of the Spread of Contagious Ophthalmia in Barracks, Schools, Workhouses, &c. 132
Prejudicial Influence on the Sight of the excessive use of Tobacco 134

APPENDIX.

Adaptation of an Artificial Eye 135

PART II.

DEFECTS OF HEARING.

CHAPTER I.

NATURE OF THE SENSE OF HEARING, AND STRUCTURE OF THE EARS.

Vital Energy of the Auditory Nervous Apparatus ... 139
Structure of the Ear 139
Transmission of Sound to the Auditory Nerve ... 140

CHAPTER II.

MANIFESTATIONS OF DISEASE OF THE EARS, AND CARE OF THEM IN GENERAL.

Dulness of Hearing or Deafness 142

PAGE
The use of Hearing Trumpets 143
Ear-ache, and the abuse of Laudanum Drops, or other applications of the kind to the Ear for its relief ... 143
Discharge from the Ear 144
Accumulation of Wax in the Ears 145
Foreign Body in the Ear 146

CHAPTER III.

CARE OF THE EARS AT THE DIFFERENT PERIODS OF LIFE.

Care of the Ears in Early Infancy, or Period at and from Birth up to Teething 147
Care of the Ears in Infancy and Childhood, or Period from the commencement of Teething up the Eighth Year ... 147
Care of the Ears in Youth and Adolescence 148
in Adult Age 149
at the Turn of Life and in Old Age ... 150

CHAPTER IV.

CARE OF THE EARS IN CERTAIN GENERAL DISEASES.

Care of the Ears in Measles, Smallpox, and Scarlet-fever 151
in Fevers 152
in Nasal Catarrh, or Cold in the Head 152

CHAPTER V.

DEAF-DUMBNESS 154

INDEX 157

PART I.

DEFECTS OF SIGHT.

BOSTON MEDICAL
JUL 18 1907
LIBRARY.

CHAPTER I.

NATURE OF THE SENSE OF SIGHT AND STRUCTURE OF THE EYES.

Vital Energy of the Optic Nervous Apparatus.

Impressions on the retina are made, in the manner to be explained below, by surrounding objects through the medium of the external agent light, and being transmitted by the optic nerve to the brain, sensations of light and colour in certain combinations are perceived by the mind.

This constitutes the act of seeing.

The sensations of light and colour, and the ideas which the mind reads off therefrom respecting the form, &c., of external objects, depend wholly on the living actions and endowments of the optic nervous apparatus, and the co-operation of the mind through its organ, the brain. When the optic nervous system is paralysed, it is no longer susceptible to the impression of light; hence, though the dioptric apparatus of the eye may perfectly perform its function, there is blindness—the camera obscura in vain throws the picture on the insensible retina.

In the act of seeing, we refer our perceptions to without and to some distance from the eye, taking no cognisance of the fact that the impression exciting the sensation is actually made on the retina, nor of the intervention of the impressing agent, light.

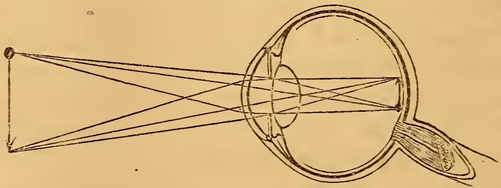
Structure of the Eyeball.

The optic nerves or special nerves of sight—two in number—are each at one end connected with the brain and at the other expanded into the nervous membrane, named *retina*, which lines the interior of the back part of the eyeball.

Like telegraphic wires, the optic nerves constitute the media of transmission between the retina, on which the impressions of light are made, and the brain, where the sensations of sight are perceived.

The segment of the eyeball in front of the retina is a dioptric apparatus or system of lenses, by which the rays of light entering the eye from external objects are so refracted or bent that they are made to converge and come to foci or points on the retina. Images of the objects from which the light comes are accordingly projected on that membrane as on the table of a camera obscura, thus:—

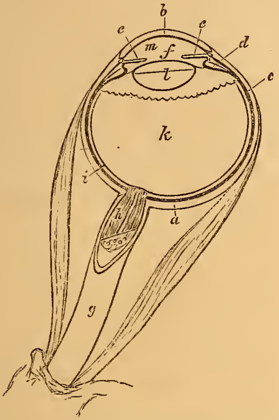
FIG. 1.



Optically considered, the eyeball is, in its construction, a true camera obscura.

The wall of the ocular chamber is composed externally of the *sclerotic coat* (*a*), except anteriorly, where

FIG. 2.



Horizontal section of the right human eyeball, natural size.*

it is formed by the transparent *cornea* (*b*), which, like a window, closes in the front of the eyeball. The sclerotic coat is lined inside by one more delicate, named the *choroid coat* (*c*), which contains much dark pigment dispersed throughout its substance. Towards the place where the sclerotic joins the cornea, the choroid coat presents a peculiar plicated structure called *ciliary body* (*d*). On the inner surface of the choroid coat again, there is a layer composed of flat six-sided cells of microscopical minuteness, filled with dark brown particles, forming the *proper pigment*

---

* The frontispiece represents the same magnified two diameters.

membrane, by which the interior of the ocular camera is darkened for a purpose corresponding to that for which opticians obscure the interior of their instruments by painting it black, viz., in order that any extraneous rays of light may be absorbed and prevented from interfering with the distinctness of the image formed on the table of the camera.

Situated behind the transparent cornea, and supported on both surfaces by the aqueous humour, is seen the *iris* (*e e*), a flat circular membrane, perforated by a round aperture, called the *pupil (f)*. The anterior surface of the iris, as seen through the transparent cornea in the living eye, is differently coloured in different individuals—blue, hazel, &c. : indeed, it is the colour of the anterior surface of the iris which, in common language, is spoken of as the colour of the eye generally; thus, a blue eye or hazel eye, means merely an eye with a blue iris or one with a hazel-coloured iris. The posterior surface of the iris is invested with a dark pigment-membrane, which is a modified continuation of that lining the inner surface of the choroid coat.

The iris perforated by the pupil, thus situated behind the transparent cornea, is, in the camera of the eye, what the shutter with the hole in it is in the primitive form of the camera obscura, or what a stop or diaphragm is in more perfect instruments. But more than this, it is a stop or diaphragm, the aperture of which is variable in size, and self-adjusting. By means of the contractile power with which the iris is endowed, the pupil admits of being varied in size; but not alone this,—there is a provision by wihch the contractile power of the iris is called into operation without any effort on our part, under the very circumstances which require the variation in the size of the pupil, viz., in bright light, contraction —in dull light, dilatation of that aperture.

The *retina (i)*, or expansion of the optic nerve, it has been above mentioned, lines the interior of the back part of the eyeball, being situated within the pigment membrane, and is the table on which, in our ocular camera obscura, the image of external objects is projected by the dioptric apparatus placed immediately in front of it. The curious and complex structure of the retina, it would be out of place to describe here.

The dioptric apparatus of the eye consists of the *vitreous humour*, the *crystalline lens*, the *aqeous humour*, and the *cornea*.

The *vitreous humour* (*k*) is a transparent jelly-like mass, which fills the posterior and middle part of the interior of the eyeball. It is concavo-convex in shape. Its convexity, which is behind, is in close apposition with the concave surface of the retina; in its concavity, which is directed forward, the crystalline lens lies imbedded.

The *crystalline lens* (*l*) is double convex, but unequally so. The more convex surface is the posterior and is sunk in the concavity which the vitreous humour presents anteriorly.

In front of the crystalline lens is the *aqueous humour* (*m*), which owes its shape to that of the cavity wherein it is contained. The cavity in question is convex anteriorly, and concave posteriorly, being bounded in the former direction by the posterior and concave surface of the cornea; and in the latter dir tion by the anterior convex surface of the crystalline lens. Furthermore, this cavity containing the aqueous humour is subdivided by the iris into two compartments, communicating through the pupil, called the *anterior and posterior chambers of the aqueous humour.*

Lastly, the transparent watch-glass-shaped *cornea,* at the same time that it closes in the front of the eyeball, forms an important part of the dioptric apparatus.

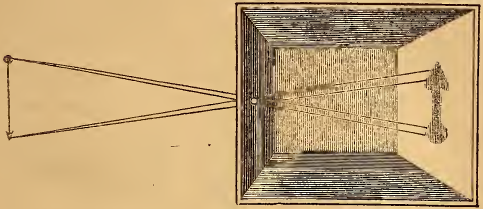
Of the Projection of Images on the Retina.

In order that the mechanism by which images are projected on the retina may be more readily understood, it will be useful to premise a brief explanation of the projection of images on the table of the *camera obscura.*

It is a law of light, that its rays, as long as they continue in the same medium, proceed in straight lines. Of the rays of light which diverge in straight lines in all directions from the different points of any external object, some will enter a hole in the shutter of a window looking towards the object, while others will be stopped by the shutter. The rays which enter the hole continue their straight course within the chamber, the window of which is closed by the shutter, until they are stopped by the opposite wall, or by a sheet of white paper held up opposite the hole in the shutter. On the wall, or on the sheet of paper on which the rays of light are received, there is seen a picture of the external object whence the rays of light, which entered the hole of the shutter, came.

In regard to this picture, it is to be observed that it is inverted and ill-defined, thus:

FIG. 3.

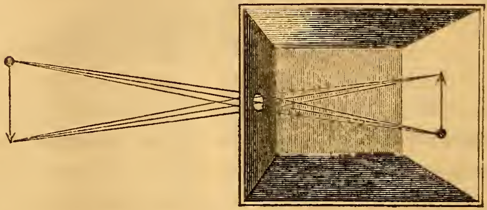


The cause of the inversion of the picture, it will be seen from the diagram, is that the rays of light from the upper part of the object which enter the hole, continuing their rectilineal progression within the chamber, necessarily impinge on the lower part of the wall or paper, while the rays from the lower part of the object as necessarily impinge on the upper part of the wall or paper; and so on with the rays from the sides and intermediate points of the object.

The cause of the imperfect definition of the picture, again, is, that the rays of light which form it do not impinge on the wall or paper in points or foci corresponding to those of the object whence they issued, but in a state of divergence, as may be seen in the diagram.

If a convex lens be inserted in the hole of the shutter, the image is no longer indistinct, but well-defined when the sheet of paper on which it is projected is held at a certain distance behind the lens. The explanation of this is, that the rays of light diverging from all the different points of the object are so refracted or bent from their original direction in passing through the convex lens, that they are rendered convergent, and so meet again in foci or points, as they fall on the sheet of paper, corresponding to those points of the external object whence they originally diverged, thus:

FIG. 4.



It will be seen from the diagram, that though distinct from accurate definition, the picture is still inverted, for the same reason that the picture, formed without a lens in the hole of the shutter, is inverted.

To come to the projection of images on the retina:

That a well-defined picture is projected on the retina, as shown in the diagram (p. 4), may be actually demonstrated by taking the eye of an animal newly slaughtered, such as an ox or a sheep, and cutting away a piece of the sclerotic and choroid coats at its back part, when by directing the cornea towards any object, a lighted candle for instance, we shall see a small inverted picture of the object shining through on the exposed retina like the image on the screen of the phantasmagoria. A similar demonstration may be given on a white rabbit's eye, without other preparation than dissecting clean the posterior surface of the sclerotica.

Like the lens of the camera obscura, the ocular dioptric apparatus so refracts or bends the rays of light, which enter the eye in a state of divergence from the several points of an external object, that they are made to converge to points or foci. These points or foci of light impinge on the retina, as on the table of a camera obscura, in the same relative order as that in which the rays forming them originally diverged from the several points of the external object.

As to the particular action of the dioptric parts of the eye on the rays of light in their course to the retina: of the pencils of rays diverging from the various points of external objects, those only which fall on the cornea, and are transmitted by it to the aqueous humour, and thence through the pupil to the retina, are concerned in vision. Those rays which fall on and pass through the circumferential part of the cornea are stopped by the iris, and are either reflected or absorbed by it. The effect of the refraction by the cornea, and of that by the different humours on the rays, is to make them converge; hence, each pencil represents two cones, with their bases touching each other at the anterior surface of the cornea, fig. 1, p. 4.

Of all the dioptric parts of the eye, the cornea is that which contributes most to the convergence of the rays of light. This is because the rays enter it from the air, which is of so much less refractive density than the cornea. The crystalline lens, though double convex, and of greater refractive density than the cornea, contributes comparatively little to the convergence of the rays of light, because the latter enter the crystalline lens from the aqueous humour, the refractive density of which is not so much exceeded by that of the crystalline as the refractive density of the air is by that of the cornea. The aqueous humour being somewhat less dense than the cornea, and presenting a convex surface to the incident rays, the convergence which the light acquired in passing through the cornea is slightly diminished on entering it. The vitreous humour, on the contrary, continues, and slightly augments the convergence of the rays which enter it from the crystalline lens, as it is of less density than that body, and presents a concave surface to the incident rays.

The curvatures of the refractive media of the eye are not spherical, but such as are calculated to bring all the rays of light to one focus, so that there is no spherical aberration. In like manner, the concave surface of the retina is not spherical, but of such a curvature as to be in its principal parts at a due focal distance behind the cornea and lens, one of the conditions for the prevention of distantial aberration.

If there had not been a convergent optical apparatus in front of the retina, but if that nervous expansion had been exposed to the impression of light equally all over its surface, we could have seen nothing but a uniformly luminous field.

There have been, and are persons, however, who pretend they can *see*—mark, *see*—to read with the fingers, the pit of the stomach, the back of the head, and the like.

If with eyes destitute of optical apparatus we could have perceived the presence of light only, but could not have recognised objects, it is evident that with the skin, which has no optical apparatus, it must be impossible to see objects, even supposing the nerves of the skin to be as susceptible to the impression of light as the optic nerve, which is not the case. It need scarcely be observed that to distinguish by the touch raised letters, and even recognise the colour of objects by the grain of their surface, as the blind can learn to do, is quite another thing.

CHAPTER II.

DEFECTS OF SIGHT REQUIRING THE USE OF SPECTACLES, AND ON THE SELECTION OF THE APPROPRIATE GLASSES IN EACH PARTICULAR CASE.

Refraction by Convergent Lenses, and the Adjustment of the Eye to Different Distances.

The rays of light from distant objects, though not strictly parallel, are usually assumed to be so.* The focus to which such rays are brought by a convergent lens is called the *principal focus of the lens.*

If rays do not come from such a distant body as to be parallel, but are more or less divergent, then the focus to which they are brought, is farther off from the lens than its principal focus, *viz.*, at some point between this and infinite distance. The point in question is nearer the principal focus the more distant the body whence the rays emanated, in other words, the more nearly parallel they are; and *vice versâ.*

From this it will be perceived, that if the refractive media of the eye were incapable of change, either as regards power, or as regards their relative position to the retina, the rays of light from objects at one particular distance only, would be collected into foci on the retina. (Fig. 5.) Rays from objects farther from the eye than that distance (*a*) would come to foci, before arriving at the retina, and having crossed (*b*) would fall on the retina in circles of dissipation (*c*). (Fig. 6.) Rays from objects nearer (*a*) would not come to foci, except behind the retina (*b*), on which therefore they would fall likewise in circles of dissipation (*c*). (Fig. 7.)

---

* The rays of light from objects beyond the distance of twenty feet are arbitrarily assumed to be parallel. Rays from objects within the distance of twenty feet are divergent.

Fig. 5.

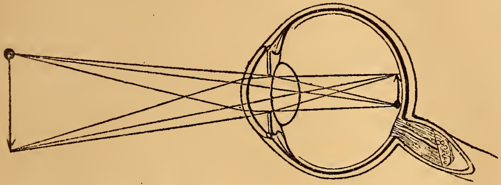


Fig. 6.

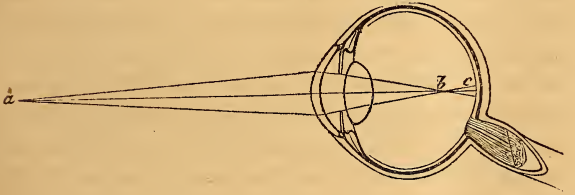
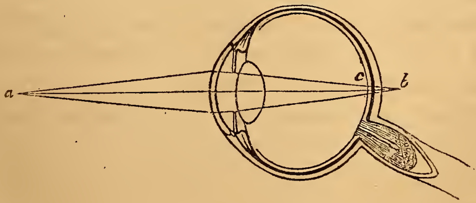


Fig. 7.



The result of this would be, that objects could be seen perfectly distinctly only when situated at one particular distance from the eye. But we know that this is not naturally the case. We know that objects can be seen, by young eyes at least, *perfectly* distinctly at different distances, within certain limits. Hence the eye must admit of adjustment to different distances, like our optical instruments.

Here the distinction is to be explained between perfect and distinct vision. In perfect vision, the outline, colour, and details of the object appear traced with the utmost accuracy, clearness, and strength; and this we have only when the rays of light are brought accurately to foci on the retina. In distinct vision, larger objects are seen so well, that they are readily recognised: the title-page of a book, for example, can be easily read, but there is a want of clearness of outline and strength of tint, and small objects or the details of large objects are imperfectly recognised; this is owing to the rays of light not falling on the retina in exact foci, but in small circles of dissipation.

When looking at near objects, the axes of the eyeballs are converged, and the pupils are contracted. When looking at distant objects, the axes of the eyeballs are parallel, and the pupils are dilated; but these variations in the direction of the eyeballs and size of the pupil are merely a concomitant and auxiliary, not an essential condition.

With a contracted pupil, or by looking through a small aperture, a far-sighted eye can see near objects, and a near-sighted eye distant objects, more distinctly. This is owing to the exclusion of the extreme circumferential rays of the cones of light which enter the eye, and the consequent diminution of the circles of dissipation on the retina.

The change in the Condition of the Eye on which Adjustment depends.

Adjustment of the eye for different distances depends on a change in the convexity of the crystalline lens.

That an increase of the convexity of the anterior surface of the lens takes place in adjustment of the eye for the vision of near objects, is shown by the diminution in *size*, and change in *position* of the image of a candle held before the eye, as reflected by the anterior surface of the lens.

That the anterior surface of the lens is, on the contrary, less convex and less near the cornea when the eye is viewing distant objects, is shown by the larger size and different position of the reflected image of the candle.

The changes in the convexity of the crystalline lens referred to, are effected by a muscular apparatus.

Differences in the Length of Sight of Different Persons.

Some persons are able to see distinctly now at very great distances, now near at hand, while others cannot see at any great distance, though they see distinctly at various short distances.

In the first case the power of the refractive media of the eyes is in such correspondence with the distance at which the retina is spread out behind, that the changes in the convexity of the lens effected by the adjusting apparatus are sufficient to enable the eye now to bring parallel rays,—now variously divergent rays to foci on the retina. Such eyes—named *Emmetropic* or *standard-sighted*—can, therefore, see both the most distant objects and objects at various degrees of proximity—as near, perhaps, as four inches in childhood, but usually not nearer than six or eight inches in adult age.

In the second case, the power of the refractive media of the eye is not in such nice correspondence with the distance at which the retina is spread out behind. The antero-posterior axis of the eye-ball is more elongated than natural, so that the retina lies at a greater distance behind the lens. The consequence is, that although the adjusting apparatus may be normal, parallel rays, or the rays from distant objects are brought to foci before reaching the retina (fig. 9), so that, after crossing, they diverge and fall in circles of dissipation on that membrane, yielding an ill-defined image. The focus of divergent rays or rays from near objects being at a greater distance behind the refractive media will, in such eyes, impinge on the retina. And, by the variations in the convexity of the lens effected by the adjusting apparatus, the rays of light are brought to foci on the retina, now of one degree of divergence, now of another degree, so that, as mentioned, the eyes possessed of the conformation in question, and which are named *Myopic* or *near-sighted*, can see distinctly at various short distances:—the medium distance being proportionate to the refractive power; the nearest distance to the near adjusting power, and the furthest distance to the far adjusting power.

To see objects at a distance distinctly, such persons require *concave* glasses of suitable focus in order to give the necessary degree of divergence to the rays on entering the eyes.

If a myopic person, whose power of near adjustment is lost or suspended, can see distinctly only at the distance of ten inches, he will require a concave glass of ten inches negative focal length to see distant objects —that is, to enable his eyes to bring parallel rays to a focus on the retina. The degree of myopy in this case is expressed thus:—10.

In some eyes—those named *Hypermetropic* or *over-sighted*—in their passive state or state of relaxation of adjustment, even parallel rays are not brought to a focus on the retina, but tend to come to foci only behind that membrane, on which therefore they impinge in circles of dissipation and consequently make an indistinct impression.

In such cases the power of the refractive media of the eyes is not in correspondence with the distance at which the retina is spread out behind. The antero-posterior axis of the eyeball is shorter than natural, so that the retina lies at a less distance behind the lens. The consequence is, that without an effort of the near adjusting apparatus, even distant objects cannot be seen—*i. e.*, even parallel rays cannot be brought to foci on the retina. The principal focus falls behind the retina. (Fig. 10.)

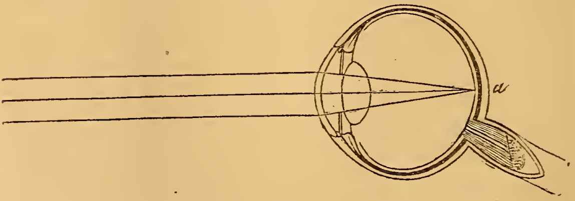
To see a distant object distinctly, therefore, a *convex* glass of suitable power is required in order to bring the rays from their parallel to a convergent state, so that the refractive power of the eye may be assisted in bringing them more quickly to foci, in accordance with the short distance at which the retina is spread out behind.

If a hypermetropic person, with his near adjustment lost or suspended, requires a *convex* glass of twenty inches focal length to see distant objects—that is, to converge parallel rays so much that on entering his eyes they may be brought to foci on the retina—his degree of hypermetropy is expressed thus: +20.

Range of Adjustment.

If an emmetropic person has the power of adjusting his eyes for the vision of near objects lost or suspended, and if it is only at a distance that he can see distinctly—in other words, if his eyes are capable of bringing parallel rays only to a focus on the retina (fig. 8) the focal power of the convex glasses which he will require to enable him to see to read will be such as will render the rays radiating from the distance at which he desires to read—say ten inches from the eye

Fig. 8.



—parallel before entering it. The focal length of such glasses will be ten inches.

If a person is not so very far-sighted, but can see objects distinctly at twenty-four inches distance, for example, the power of the convex glasses which he will require to enable him to see to do any fine work at, say, ten inches distance, will be such as will reduce the divergence of the rays radiating from a point at that distance from the eye to the degree of divergence of rays radiating from a point at the distance of twenty-four inches. The focal length of such glasses may be determined by multiplying the two distances twenty-four and ten together, and dividing the product 240 by the difference between them, viz., fourteen. The quotient, seventeen (omitting the fraction), is the focal length in inches of the glasses required.

Suppose, now, a person has the power of adjusting his eyes so as to be able to see distinctly at any distance from ten inches to infinite distance, his range of adjustment may be expressed by the power of the convex lens required to refract the rays radiating from ten inches distance, so that they may be rendered parallel, viz., ten inches focus.

But suppose a person can see distinctly only at any distance from eight to twenty-four inches, his range of adjustment will be expressed by the power of the lens required to refract the rays radiating from eight inches distance, so that they may be brought to the degree of divergence of rays radiating from a point at the distance of twenty-four inches, viz., twelve inches focus.

Test Letters for Ascertaining the Degree of Distinctness of Sight.

The following sizes of letters may be seen by a normal eye from the distance in feet, indicated by the numbers marked over them respectively:

If a person sees No. 1 at one foot, No. II at two feet, and cannot see No. XX at twenty feet distance, myopy or near-sightedness exists. If, on the contrary, he sees No. XX at twenty feet, and does not see No. I at the distance of one foot, the nearest point of vision lies at more than one foot from the eye.

I.

n p r t v s b d f h k o l

II.

F H K O S U Y A B C G L 2

III.

C E G L N P R T V Z B D 3

IV.

V P B D F H K O S U Y A 4

V.

J U Y V C E G L N P R T 5

VI.

N P A T V Z B D F H K O 6

VII.

F H K O S U Y A C E G L 7

VIII.

C F G L N P R T V Z B D 8

X.

V Z B D F H K Q 10

XII.

I U Y V C E G 12

XV.

N F R T V Z B 15

XX.

U Y A E G 20

Myopy, or Near-sightedness.

When objects can be seen perfectly distinctly only at so short a distance that the rays of light received from them are very divergent, the eyes are said to be *myopic* or *near-sighted* and the state of vision is designated *myopy* or *near-sightedness.*

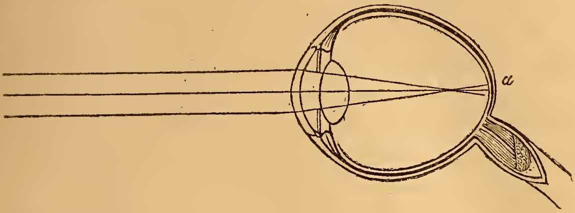
In the slighter degrees of myopy, which are common enough, the indistinctness with which objects at a distance are seen not being very incommoding, the person may remain unconscious of his defect until he happens, by chance perhaps, to look through a shallow concave glass, and discovers that he sees objects at some distance with unaccustomed clearness and definition. In such a case the person will probably find that without concaves he can see distinctly at no greater distance than two, three, or four feet, whilst at the distance of twelve or twenty feet he sees indistinctly.

In trying to view distant objects, the near-sighted person half closes his eyelids. By this means the extreme circumferential rays of the cones of light entering the eyes are cut off, especially above and below; the effect of which is that horizontal lines are seen better defined.

The name of myopy for near-sightedness is derived from this habit of half closing their eyelids which near-sighted people acquire.

Too great a distance of the retina behind the crystalline lens, from preternatural elongation of the antero-posterior axis of the eyeball, we have seen, is the condition on which myopy or near-sightedness most commonly depends. (Fig. 9.)

FIG. 9.



The rays of light from distant objects—that is, rays of light parallel or but slightly divergent—thus come to foci before impinging on the retina, cross, and are in a state of dissipation when they do impinge on that nervous membrane. The consequence thus is the projection of ill-defined images of the distant objects.

Preternatural elongation of the antero-posterior axis is owing to a bulging out of the back part of the eyeball, named *posterior sclerotic staphyloma.*

In myopy the power of adjusting the eye is still retained, and fails only, as usual, with the advance of life. The range of adjustment may, indeed, be as great as in the emmetropic eye, only it comprehends nearer distances. With one pair of concaves fitted to correct the effects of the myopic conformation of the eyes, the person still possessing the power of adjustment is often able to see distinctly both near and distant objects, like an emmetropic person.

On failure of the adjusting power with advance of life, a near-sighted person, whose eyes are otherwise fairly sound, ceases to see well so very near as he used to do. He ceases also, perhaps, to see well so far off. He continues, however, to see well at an intermediate distance. And if that distance happens to be about eight or ten inches, he is not much incommoded so far as reading and writing are concerned.

To be able to read and write without spectacles by candlelight after fifty indicates myopy.

With good adjustment, myopic persons see small objects more distinctly than other people, because, from their nearness, the objects are viewed under a larger visual angle.

They see them also with a weaker light, because, the objects being near, a greater quantity of rays from them arrive at the eye.

Myopic persons prefer small print or writing to read, and short lines. Long lines, in consequence of the great degree of convergence of the two eyes in reading, cannot be surveyed at a glance, as they can be by a far-sighted person, who, holding the book further off, does not require to converge his eyes so much.

A great inconvenience attending the higher degrees of myopy is the necessity the persons are under of stooping over their work.

In many cases there are no peculiar appearances presented by the eyes of myopic persons; but frequently the eyes are prominent and firm, the cornea very convex, the anterior chamber deep, and the pupil dilated. Very prominent eyes are, however, sometimes met with perfectly emmetropic.

When the near-sightedness is very great, the necessary degree of convergence of the two eyes on the book for binocular vision cannot be maintained without fatigue. The person, therefore, gets into the habit of reading with one eye. In extreme cases divergent squint is liable to supervene.

True or optical nearsightedness under consideration is to be distinguished from the apparent shortsightedness which depends on defective sensibility of the retina. In this latter form, which may be named amblyopic shortsightedness, although objects are seen better near at hand, they are not seen distinctly, as in true shortsightedness; and help is obtained from convex instead of concave glasses.

In amblyopic shortsightedness, near objects are, as above said, seen better. This is because they are seen larger, and by a greater quantity of light. On the same principle, convex glasses help the sight. Well illuminated objects are seen better, on account of the stronger impression made on the retina.

An analogous form of shortsightedness is occasioned by impaired transparency of the lens.

Myopy or true nearsightedness seldom occurs in so great a degree before puberty as to be troublesome. After puberty, when the eyes come to be used in earnest, nearsightedness is usually first discovered to exist, and it may go on gradually increasing, especially if the person uses his eyes much in reading, and on minute objects. Such exertion of the sight involves strong convergence of the eyes, and a stooping position, which tend very much to promote determination of blood to the eye, and so aggravate the posterior sclerotic staphyloma, on which the nearsightedness depends. Hence the greater frequency of shortsightedness among the educated classes, and those whose occupation is with minute work. Myopy does not diminish with years. We meet with persons of the most advanced age who still find it necessary to use glasses as deeply concave as they did in youth, if not more so.

Predisposition to myopy is congenital, and nearly always hereditary.

From what we have seen of the condition of the eye causing nearsightedness, it is clear that the eye must not only remain near-sighted, but be liable to become more so. A radical cure of short-sightedness is, therefore, out of the question.

Any apparent diminution which may occur arises from flattening of the lens, with diminution of its refractive power.

To persons whose occupation is with minute objects near-sightedness, unless in a very great degree, is rather an advantage, as they are enabled to observe all the details of their work very accurately; and in the ordinary exercise of vision for distant objects the use of concave glasses is a ready and simple help.

When very near-sighted, however, a person requires to use concave glasses, not only to be enabled to see distant objects, but also for reading with, in order to avoid too strong convergence of the eyes and the necessity of stooping. For the latter purpose shallower glasses suffice.

When a tendency to near-sightedness manifests itself in young persons, much exertion of the eyes on minute work should be avoided, and the eyes frequently exercised on large and distant object—objects not nearer than fourteen or sixteen inches—and on scenes in the open country.

Concave glasses help the vision of near-sighted persons for distant objects, simply by increasing the divergence of the rays of light before they enter the eye, so that, supposing the refractive power of the media of the eye not increased but the distance of the retina behind the lens increased, they may be brought to foci at a greater distance behind the lens than they would otherwise have been, in order to correspond with the greater distance of the retina behind the lens.

An eye which can see distant objects distinctly—that is, can bring parallel rays to foci on the retina—and which can see objects distinctly at any ordinary distance up to six or eight inches—that is, can bring more or less divergent rays to foci on the retina—may, we have seen, be viewed as a model eye. It is the eye named emmetropic.

An eye under the influence of atropia—that is, having its adjusting muscular apparatus for distant objects excited to full action, which can see near, but which still cannot see objects at any considerable distance distinctly—that is, cannot bring parallel rays to a focus on the retina—is *myopic*.

If the person whose eye has been put into this state by the surgeon be supplied with concave glasses, enabling him to see distant objects—that is, glasses fitted to render parallel rays somewhat divergent before entering the eyes—his sight is practically rendered emmetropic, if the adjusting power of his eyes is good.

When the action of the atropia subsides, the adjusting muscular apparatus for distant objects relaxes, and the person, with his spectacles on, can, like the person with emmetropic eyes, see objects at medium distances, and, by the exercise of the adjusting muscular apparatus for near objects, can see distinctly near and minute objects at any ordinary distance up to six or eight inches.

Choice of glasses for near-sighted eyes.—Concave glasses are made of different degrees of concavity, the shallower being those adapted for the slighter degrees of near-sightedness, the more concave for the greater degrees.

Young near-sighted persons with good adjusting power may use spectacles with concaves of one negative focal length for all distances: the glasses being sufficiently deep to render slightly divergent or even parallel rays on their entrance into the eye when in a state of far adjustment, divergent enough to be by the refractive media brought to foci on the unnaturally deeply-seated retina. The near-adjusting apparatus being called into action when near objects are looked at, the refractive power of the eyes is so increased that the rays from the near object which are divergent, and which are rendered still more so by the deep concave glasses, are brought to foci on the retina.

The power of lens to be selected is that which will neutralise the myopic conformation of the eyes, and thus enable the person to see distant objects distinctly. The lowest power which will effect this is to be chosen.

When the adjusting power of the eye is impaired or has not been exerted from youth, by wearing neutralising concaves, it will be necessary to use glasses of less concavity to read with than are necessary for viewing distant objects.

The negative focal length of the concave glass which a person will require to see objects at a distance should be about equal to the distance at which he can see to read distinctly an ordinary type with the naked eye—six inches, for example.

Such glasses impart to the parallel rays from the distant objects a divergence equal to that which rays from objects at the distance of six inches would have, and so the eyes are enabled to bring them to foci on the retina.

To determine whether such glasses will suit for the ordinary exercise of vision, the myopic person should look with them at letters XX. (p. 23), placed at the distance of twenty feet, and see how he is able to read. Glasses the next degree shallower are then to be tried instead, and afterwards glasses of the next degree deeper. The person will thus be enabled to judge whether the pair of glasses fixed on by the calculation be practically of too strong or too weak power, or quite suitable.

In wearing spectacles, the glasses are necessarily at a certain distance from the eyes. If the person finds he sees better by bringing them closer to the eyes, then the glasses are not sufficiently concave. If, on the contrary, the person finds he sees better by removing them a little further from the eyes, the glasses are too concave. The reverse holds with respect to convex glasses.

The focal length of the concave glass which a very shortsighted person will require to see to read at a convenient distance is determined thus:—Suppose he sees to read with the naked eye at the distance of six inches, and desires to be able to read at the distance of twelve, the one distance is multiplied by the other, and the product seventy-two divided by the difference between the two distances—viz., six. The quotient twelve is the number of inches the focal length of the glass required should be.

But when a person finds it necessary to have recourse to glasses for nearsightedness, he should go to an optician, and select two or three pairs which appear to assist his vision best; or send for two or three pairs of about the focal length which, according to the above calculation, he thinks will suit him, and try them leisurely at home for a day or two before fixing his choice on one particular pair.

The following are the circumstances which should guide him in his choice :—

The glasses should be of a power which will enable him to distinguish objects as he wishes, quite readily and clearly, and at the same time comfortably. If they should make objects appear small and very bright, and if in using them the person feel his eyes strained and fatigued, or if he becomes dizzy, and if after putting them aside the vision is obscure, they are not fit for his purpose—they are too concave.

Having once fitted himself, a person should not too hastily change his glasses, although they may appear not to enable him to see quite so clearly as when he first used them.

In high degrees of myopy, the improved definition from deep concaves is counterbalanced by the diminished size of the image; the person, therefore, prefers shallower concaves for use than the high degree of myopy would indicate. In very high degrees of myopy, being no longer able to converge the two eyes without straining, he prefers using one eye only, and that often without the help of any glass at all.

Except in such extreme cases, a glass to each eye should always be employed; vision is by this clearer, and its exercise less fatiguing to the eyes, than when a glass to one eye only is used. The use of a glass to one eye only is, in fact, very detrimental, especially to the opposite eye.

A person who has not from youth used concaves deep enough to neutralise the myopic conformation of his eyes, or not used concaves at all, has necessarily not had occasion to exercise his near-adjusting power much. That power, having thus lain long in abeyance, cannot be afterwards brought fully into use. The person, therefore, cannot take to neutralising concaves. He must use glasses no deeper than is sufficient to enable him to see at the particular distances required —for reading or writing with, for reading music, or for distant vision.

In cases of myopy in which the medium distance at which objects can be seen distinctly is, let us say, twelve inches, when the adjusting power is lost with the advance of life, convex glasses are required to render the vision distinct at nearer distances than twelve inches, and concave glasses to render the vision distinct at further distances.

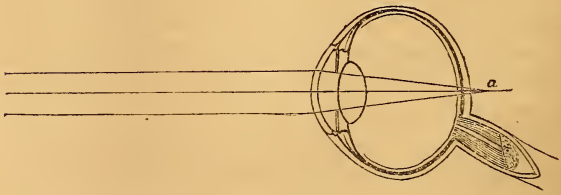
Care of the eyes in myopy.—If symptoms of internal congestion, such as a feeling of fulness and irritation, present themselves, and if fatigue and pain in the eyes come on by using them, especially by candle-light, all work must be suspended and stooping avoided. The closed eyes are to be douched with cold water, and attention directed to the liver and bowels.

When, as is sometimes the case, the eyelids of short-sighted people are tender and irritable, the sight should not be much used in reading or sewing. In such cases it is useful occasionally to bathe the eyebrows and temples with some cooling lotion.

Hypermetropy, or Over-sightedness.

Hypermetropy is the reverse of myopy. Whilst in the myopic eye the retina is so far behind the crystalline that even in the lowest state of refraction to which the eye can be brought by the exertion of its far-adjusting apparatus, parallel rays, or even moderately divergent rays, are brought to foci before reaching it, so that objects at any considerable distance cannot be distinctly seen; in the hypermetropic eye, on the contrary, the retina is so close behind the crystalline that in the state of refraction corresponding to the relaxation of all adjustment, and still more in the lowest state of refraction to which the eye can be brought by the exertion of its far-adjusting apparatus, even parallel rays are made to converge so little that they tend to come to foci only behind the retina, so that objects cannot be seen distinctly at any distance —far or near. (Fig. 10.)

Fig. 10.



Hypermetropic eyeballs are small and sunk. The cornea is often small and dull-looking, and apparently, if not actually, flatter than natural, in consequence of the lens and iris being inclined towards it, so that the anterior chamber is diminished in depth.

Hypermetropy is often hereditary.

As, without the exertion of the near adjustment, hypermetropic eyes cannot bring parallel rays, much less divergent, to a focus on the retina, they cannot see distinctly either distant or near objects. To see without an effort of near adjustment, convex glasses are required, in order to render the rays, at their very entrance into the eye, convergent, so that the refractive power of the latter may be enabled to bring them to foci at a short enough distance behind the crystalline to impinge on the retina.

In hypermetropy the power of adjusting the eye exists, and fails only, as usual, with the advance of life.

In respect to the exercise of the adjustment for near objects, it is to be observed—that in order to bring divergent rays to foci on the retina, it has to increase the refractive power of the eye from a state in which even parallel rays cannot be brought to foci on the retina. This implies an unnaturally great exertion on the part of the near-adjusting apparatus, and one which is not in relation with the convergence of the visual lines of the two eyes. Indeed, in order that such an effort may be made, the eyes must be at the same time very much converged, as above mentioned.

In some extreme cases the eyes are incapable of an intermediate moderate degree of convergence and adjustment, so as to see at the distance, say, of eight or ten inches. When the patient tries to read, the adjustment is by a spasmodic effort made for so short a distance that he holds the book close to the eye, and thus appears to be very near-sighted; whilst in consequence of the accompanying great convergence of the visual lines the two eyes cannot be simultaneously fixed on the object looked at. One eye only is therefore used, and convergent squint of the other takes place.

Hypermetropy in young persons may thus be mistaken for myopy, combined with some degree of amblyopy.

Convex glasses, by rendering the spasmodic effort at near adjustment unnecessary, enables the person to see at a proper distance; so that we have the apparent anomaly of a very short-sighted person being enabled to see further off with convex glasses.

By the use of suitable convex glasses—glasses strong enough to neutralise the hypermetropic condition of the eyes are required—a displacement of the relative range of adjustment is effected, so that the necessary harmony between convergence of the eyes and their near-adjusting power is established. The person is thus enabled, by the exercise of the adjusting power, now to read without undue convergence, now to see distant objects with parallel visual lines.

By the fact that distant objects are seen more distinctly with convex glasses, the existence of hypermetropy is declared.

It is here to be remarked that an originally hypermetropic eye may have the far-adjusting power as well as the near; but the effect of the exertion of the former is, on account of the conformation of the eye, worse than no adjustment. Unfocalizing the eye still more, it is not usually called into play, but by atropia the surgeon can excite to action the far-adjusting apparatus, and thus render manifest the *latent* hypermetropy.

In early life, with good adjustment, hypermetropy in a moderate degree may not be much complained of, but, as with the advance of life the adjusting power becomes impaired, prolonged exertion of the sight in reading, sewing, or other fine work, comes to be difficult or impossible. Asthenopy has then set in.

Persons requiring convex glasses at about thirty-five or forty years of age, or even younger, will probably be found hypermetropic.

With the advance of life the adjusting power of the eye for near objects, even with the strongest convergence of the eyes, fails, and the person ceases to be able to read without convex glasses adapted for the particular distance at which he wishes to see to read.

To see distant objects, convex glasses of a lower power are required.

Choice of glasses for hypermetropic eyes.—Try the eyes with convex glasses until the strongest are found with which the person sees distant objects distinctly—*i. e.* the strongest convex glasses required to render parallel rays, or the rays from distant objects, convergent enough on entering the eye to admit of being brought by its refractive power to foci on the retina, which is spread out at so short a distance behind the crystalline lens.

Practically, it will be sufficient to try with what power of convex glass the patient can see to read the letters No. XX (p. 23), at the distance of some twenty feet. Usually this will be found to be forty-eight or thirty-six inches focal length. Sometimes, however, eight or six.

It may happen that in this trial the near-adjusting power of the eye is still unconsciously called into play, so that the full degree of hypermetropy is not manifest. To render evident the full degree of hypermetropy the surgeon calls the far-adjusting apparatus into action by the application of atropia.

As atropia excites the far adjustment of the eye, the convex glasses which enable the eye under the influence of atropia to see distant objects—that is, convex glasses of such a power as combined with that of the refractive media will bring parallel rays to foci on the retina, and thus render the eye practically emmetropic—are the power to be chosen.

With such convex glasses the patient, if the adjusting power of his eye be good, will see surrounding near objects distinctly when, by the cessation of the action of the atropia, relaxation of the far adjustment takes place, and will see to read by an exertion of the near adjustment. For this purpose, however, it is usually found that glasses of greater convexity are required. Glasses, namely, of such a power as will enable the person to see quite distinctly at the distance of twelve or sixteen inches, without exertion of their near adjustment, and at a nearer distance by exertion of the near adjustment.

The required power may be ten or even six inches.

Convex glasses of low power appear to help well in hypermetropy for reading or sewing, but this is because, with the convergence of the eyes, the near-adjustment to a great degree comes into play—to a greater degree than is desirable. Substitute stronger convex glasses, and this habit of over-exerting the near-adjusting apparatus will be rendered unnecessary.

Myopic persons, it has been above shown, are naturally not necessitated to exert their near-adjusting power much. Hence, if they do not in youth begin to wear concave glasses deep enough to neutralise the myopic conformation of their eyes, and thus necessitate themselves to exert their near-adjusting power in reading, &c., they find it difficult to do so later in life. They can only use the deeper concaves for distant objects, and shallower for near objects.

Hypermetropic persons, on the contrary, are naturally necessitated to exert their near-adjusting power to the utmost. Hence, if they do not in youth begin to wear convex glasses sufficiently powerful to correct the hypermetropic conformation of their eyes, and thus necessitate themselves to exert their near-adjusting power less—if not, even, to exert their far-adjusting power, they find it difficult to use, for distant objects, convex glasses of a power strong enough for reading or sewing.

They are disposed to select glasses to see distant objects with of a lower power than will subsequently be desirable. This is because the habit of exerting their near-adjusting power to the utmost is unconsciously still persisted in while the glasses are being tried. After using for some time the glasses selected, however, the patients become able to relax the near-adjusting power when trying other glasses. They then find that with stronger convexes than those they had at first chosen they can exercise sight with less straining and more comfortably.

When, with the advance of life, the adjusting power is lost, the hypermetropic eye cannot see distinctly at any distance, but requires, like a person who has undergone the operation for cataract, convex glasses of a lower power for viewing distant objects, and convex glasses of a higher power for reading or sewing.

Care of the eyes in hypermetropy.—Prolonged exertion of the sight on fine work is to be avoided. The strength and energy of the system are to be maintained by attention to diet and exercise. When the eyes feel fatigued in the course of work they are to be rested and bathed with cool water, the eyelids at the time being shut.

Presbyopy, or Old-sightedness.

With the advance of life the power of the eye to adjust itself for vision at different distances becomes impaired, and after middle-age it is usually altogether lost. After middle-age, indeed, failure of the adjusting power of the eye is so common that it is to be viewed as a natural change in the state of the eye.

The defect of sight arising from failure of the adjusting power of the eye is named presbyopy (from πρέσβυς, old, and ὀψ, the eye).

In presbyopy the person can see only at the distance which the anatomico-optical conformation of his eyes allows. The previously emmetropic eye can see only at a distance—the myopic eye still requires concave glasses for seeing distant objects, but may require convex glasses to see very near objects distinctly—while the hypermetropic eye becomes incapable of seeing at any distance without convex glasses sufficient to neutralise the hypermetropy in viewing distant objects, and still stronger convex glasses to compensate for the failure of the adjusting power in viewing near objects.

As failure of the adjusting power of the eye is not so much felt in myopy as in emmetropy, our ideas of presbyopy have been founded on it chiefly as it manifests itself in the latter, and therefore it has come to be synonymous with far-sightedness.

In treating of presbyopy, however, it will be necessary to consider it successively under the heads of presbyopy in the emmetropic eye, in the myopic eye, and in the hypermetropic eye.

Presbyopy in the Emmetropic Eye.

With this state of vision the person can see objects distinctly only when they are at a very considerable distance from the eye; in reading, for example, he holds the book at arm's length.

The power of adjusting the eye for different distances being much impaired, the rays of light from nearer objects, as they are more divergent, tend to come to a focus at a point behind the retina, on which therefore, they impinge in circles of dissipation, and form indistinct and confused images.

By removing the object from the eyes it comes to be distinctly seen, because the rays from it which enter the eye, being now less divergent than when it was near, are more quickly brought to a focus.

In trying to read, the attempt to exert the power of adjustment induces fatigue and confusion of vision, though in such a case it will probably be found that the eye is affected with hypermetropy in a slight degree.

In commencing presbyopy the near-adjusting power is not lost—it is only impaired in respect to range, so that the person can no longer adjust for a nearer distance, perhaps, than twenty inches.

As the adjusting power becomes more impaired stronger convexes are necessary. When it is quite lost convex glasses of different powers are required to correspond with the different distances of the objects looked at.

In many cases there is nothing peculiar to be observed in the affected eyes; but frequently the crystalline and iris are inclined towards the cornea, which, in consequence of the resulting diminution of the depth of the anterior chamber, appears flat. The pupil is small.

As to peculiarities of sight:—Small objects are seen indistinctly at every distance, because when near they are out of focus, and when removed from the eye somewhat they are seen at a small visual angle and with little light. The presbyopic-emmetropic person does not see so well by candle-light as before, and when attempting to read by candle-light he places, perhaps, the candle between him and the book held at arm's length.

Large and distant objects are seen distinctly.

There is no complaint of fatigue. The complaint merely is that the sight is indistinct, except for distant objects, and that lines and points appear multiplied, whether both eyes or one only is used.

The presbyopic-emmetropic eye cannot by any effort see near at hand. It can see only at some distance. With a suitable convex glass it can see near objects. The hypermetropic-asthenopic eye, on the contrary, can by an effort of adjustment see near at hand, but only for a short time. Fatigue of the adjusting power quickly supervenes, and confusion of sight takes place.

Care of the eyes in the incipient presbyopy of emmetropic persons.—Although presbyopy depends on a change in the state of the eye which takes place naturally with the advance of life, something may be done in the way of retarding its progress, and thus so far preserving the sight, by avoiding over-exertion of the eyes in reading and other minute work, especially by artificial light, at the time of life when diminution of the adjusting power usually comes on.

As soon as the eyes begin to feel hot and fatigued we should take warning and give them rest, by looking off the work before us. A person, when he does find himself to have become far-sighted, and compelled to use spectacles, should still refrain as much as possible from exertion of his vision by artificial light.

Choice of glasses for presbyopic-emmetropic eyes.—Convex glasses help the vision of presbyopic people who have been originally emmetropic for near objects, by diminishing the divergence of the rays of light before they enter the eye, so that they may be more speedily brought to foci than they would otherwise be, in consequence of the diminished power of the near-adjusting apparatus of the eye.

Presbyopic persons, at the same time that they have lost the power of adjustment for near objects, may be somewhat cataractous, or have their retina impaired in sensibility. In such cases convex glasses, besides remedying the defective adjustment, are of use by their magnifying power; somewhat stronger glasses are therefore to be ordered.

Convex glasses are made of different degrees of convexity—the least convex being those adapted for the slighter degrees of far-sightedness, the more convex for the greater degrees.

To see distant objects, emmetropic persons who have become presbyopic do not in general require convex glasses. It is most commonly to enable them to read and do minute work that they use spectacles.

If it is only at a *very great* distance that a person can see distinctly, the focal length of the convex glass which he will require to enable him to read will be equal to the distance at which he wishes to see to read. If he wishes to see to read with the book ten inches off he will require convex glasses of ten inches focal length.

If he is not so very far-sighted, but can see small objects distinctly at twenty inches distance, for example, the focal length of the convex glasses which he will require to enable him to read at twelve inches distance is determined by multiplying the two distances together and dividing the product, 240, by the difference between them, viz. eight. The quotient, thirty, is the focal length in inches of the glasses required.

But when a person finds it necessary to have recourse to glasses for far-sightedness he should go to an optician and select two or three pairs which appear to assist his vision best, or send for two or three of about the focal length which, according to the above calculation, he thinks will suit him, and try them leisurely at home for a day or two before fixing his choice on one particular pair.

The following are the circumstances which should guide him in his choice:—The glasses should be of sufficient power to enable him to see objects distinctly as he wishes, and at the same time comfortably. With glasses of too low a power fatigue and confusion of sight supervene. Glasses which make the objects appear larger than natural, and strain and fatigue the eyes and cause headache, are not adapted to his case—they are too convex. It is usually found that glasses the next degree more convex are required for work by artificial light.

The alteration in the eye on which the far-sightedness depends generally goes on to increase with age, hence it is necessary after a time—a few years—to change the glasses first chosen for others more convex. In regard to this change it is to be observed that it ought not too hastily to be had recourse to, nor, on the other hand, too long delayed. The same feeling of necessity which first prompted to the use of glasses will indicate the necessity of change.

In changing, the glasses previously used for the evening are to be adopted for the day, and a pair one degree stronger procured for evening work.

When the patient manifests a disposition to try a frequent change of his spectacles a glaucomatous state of the eye will probably be discovered on examination.

In advanced age, to total failure of the adjusting power is superadded a hypermetropic state from diminished refractive power of the media of the eye, so that even parallel rays cannot be brought to foci on the retina. To see distant objects, therefore, convex glasses are required, though of a power lower than those necessary for reading with.

Presbyopy in the Myopic Eye.

With loss of power of adjustment the myopic eye ceases to see well so near or so far off as formerly. It sees perfectly distinctly, perhaps, at one particular distance only; and that distance depends on the anatomico-optical conformation of the eyeball.

Suppose the distance to be twelve or fourteen inches, the person will require convex glasses to see nearer objects perfectly distinctly, and concave glasses to see more distant objects.

Suppose the distance at which the person can see perfectly distinctly to be about ten inches, he will be able to read, write, and do any other near work without the assistance of convex glasses to make up for the loss of his near-adjusting power.

To see distant objects, he will still require concave glasses.

Presbyopy in the Hypermetropic Eye.

With loss of power of adjustment the hypermetropic eye ceases to see distinctly at any distance. The distance of the retina behind the crystalline body being so short, even parallel rays of light tend to come to a focus only at a point behind that nervous membrane, on which, therefore, they impinge in circles of dissipation, and form indistinct and confused images.

To see distant objects, convex glasses of a power sufficient to neutralise the hypermetropic conformation of the particular eye are required; that is, convex glasses which will converge parallel rays so much at their entrance into the eye that they will admit of being brought by the refractive media to foci on the retina.

The hypermetropy being neutralised, the presbyopy or defect of adjustment still remains, so that glasses for different distances are required.

To see nearer objects, proportionally more convex glasses are required, the power being adapted to each particular distance at which it is desired to see distinctly.

As hypermetropy from diminished refractive power of the eye takes place from senile changes in the emmetropic eye, so also in the originally hypermetropic eye the hypermetropy increases in the same manner.

Mydriasis, or Simple Fixed Dilatation of the Pupil, and Paralysis of Adjustment.

The pupil is, in ordinary light, of its medium size, which is about one fifth of an inch in diameter. When the light to which the eye is exposed is strong, the pupil becomes contracted to a smaller size; but, on the contrary, when the light is very dull it is dilated to a larger size.

Dilatation of the pupil, persisting in opposition to the influences to which the pupil is ordinarily obedient, sometimes occurs, unaccompanied by any other defect of sight than may be accounted for by the accompanying derangement of the optical adjustment of the eye.

That the case is of this simple nature, and not one of that serious disease of the sight—amaurosis (of which dilatation of the pupil is a pretty common symptom), is ascertained if the patient, on looking through an aperture in a card of less than the ordinary size of the pupil, is able to see objects distinctly.

If the patient's eyes be naturally myopic, he may be still able to read or write; if emmetropic, he is unable to do so except with convex glasses, but is able to see at a distance as before; if hypermetropic, he is more incommoded, as he can see neither near nor distant objects distinctly without convex glasses.

Treatment.—In such cases special medical treatment is required.

As allied to paralysis, cases of defective sight occurring after debilitating disease, and described under the name of *paresis*, or debility of adjustment, fall to be noticed here. There may or may not be accompanying fixed dilatation of the pupil. The symptom is inability to see at so near a distance as usual. In this respect the case resembles one of presbyopy, but differs in respect to the circumstances under which it comes on. As the inability to see to read is manifest at the first attempt, the case cannot be confounded with asthenopy.

The defect of vision which has been found to occur in persons recovering from *diphtheria*—often along with debility of the muscles of speech and deglutition, and paralytic symptoms of other parts—is of this nature.

The weakness of the adjusting apparatus is of course felt most by hypermetropic and emmetropic eyes, much less by myopic eyes.

Management.—Though convex glasses help the sight for near objects, they are not to be had recourse to. With the restoration to health the eyes regain their adjusting power, and near objects are seen distinctly as before.

Towards such a consummation good diet and tonics are the auxiliaries obviously indicated.

Asthenopy, or Weak-sightedness.

An inability to exercise vision on near objects, as in reading, sewing, and the like, for any length of time. The patient is able at first to see to read distinctly enough, but the vision soon grows confused, the words appearing as if mixed together. The eyes at the same time become tired and painful, the pain extending to the head.

If the eyes are closed, and rest given to them for a few minutes, vision may be again exercised, but in a short time the eyes will become fatigued and the vision confused, as before.

Vision for distant objects is not complained of, though in extreme cases distant objects also, on being fixed, fade from the sight. By the use of convex glasses the exercise of vision on near objects is much assisted.

Asthenopy has its origin in the hypermetropic conformation of the eyeballs, which is congenital (p. 34).

The strong exertion of the near adjustment necessary to enable the hypermetropic eye to bring divergent rays to a focus on the retina—*i. e.* to enable it to see to read or sew—leads to fatigue, and the symptoms above enumerated set in.

The hypermetropic conformation of the eyeballs being congenital, asthenopy manifests itself in childhood or youth. The degree in which and the period at which it manifests itself, however, vary according to the degree of the hypermetropic conformation of the eyeball, and the amount of exertion to which the sight has been subjected, and the state of the general health. Asthenopy may manifest itself before the eyes have been subjected to any great exertion. If there be, as there often is, general debility, asthenopy is the sooner and more decidedly manifested.

BOSTON MEDICAL
JUL 18 1907

In moderate degrees of hypermetropy the sight may be exerted for a long time before any complaint is made. At last, with the advance of life, the range of adjustment diminishes, and the energy of the near-adjusting apparatus becomes impaired and no longer able to keep up, for any length of time, the over-exertion imposed upon it.

The patients who complain of asthenopy for the first time are, many of them, students, artists, clerks, engravers, watchmakers, tailors, sempstresses, &c., who have sat up late working by artificial light and who have not had sufficient exercise in the open air.

There is a form of weak-sightedness which is owing not to a hypermetropic conformation of the eyes and consequent trouble of the internal adjusting apparatus for the vision of near objects, but to defective power of the muscles which turn the eyeballs inwards, causing inability to maintain the eyes in the degree of convergence necessary for the vision of near objects. This weakness of the muscles is most common in myopy, and is the cause of the asthenopic symptoms in the near-sighted.

Another form of what may be called weak-sightedness depends on an irritable state of the eyes, and occurs as a consequence of inflammation, especially scrofulous ophthalmia, external and internal. In such a case uneasiness, redness and watering of the eyes, come on as soon as the patient tries to use them. There is often some degree of near-sightedness.

Hypermetropic-Asthenopy is principally to be distinguished from diminished power or actual paralysis of the near adjustment, and amblyopy, or incomplete amaurosis.

As hypermetropy depends on an original defect in the conformation of the eyes, a cure, properly speaking, is not to be anticipated, but much may be done to alleviate the symptoms. Asthenopy, though it has become confirmed, rarely passes into amblyopy, and is not likely to end in blindness.

Management.—Rest to the eyes, the occasional application to them of the cold douche, good diet, exercise, country air, sea-bathing, and the like, must in general constitute a leading part of the treatment of asthenopy.

When the patient requires to employ his eyes on near objects he has no other resource than to use convex glasses, to correct the hypermetropic condition of his eyes—see above, p. 36; but it would be advisable for the patient, if his occupation requires much use of the eyes, to change it, if possible, for one of an opposite kind.

Uniocular Polyopy, or Manifold Vision with One Eye.

When the eye is not adjusted to the distance of the object looked at—a black line, such as this, for instance—polyopy with one eye occurs. Instead of appearing single and well defined, the line appears multiplied, as if made up of several overlapping lines and ill defined.

Presbyopic-emmetropic people see the line multiplied when they try to look at it near at hand without their spectacles.

Presbyopic-myopic persons see the line multiplied when viewed at a distance either further off or nearer than that of their distinct vision.

Uniocular polyopy is to be distinguished from double vision with two eyes. The latter is owing to a loss of correspondence in the direction of the axis of the two eyes, and, even if there be no evident squint, it is at once distinguished by closing one eye, when the object looked at will be seen single by the open eye. That a case is one of uniocular polyopy will be shown if the object is seen single with the help of a concave or convex glass, according to its distance, and according as the patient is near or farsighted—that is, supposing the patient's eye to be free from astigmatism.

Unequal Power of the Two Eyes.

The two eyes may be in different degrees myopic or hypermetropic; or one may be emmetropic, and the other myopic or hypermetropic; or one may be myopic and the other hypermetropic.

When the two eyes are still capable of being used in concert in binocular vision, though in different degrees myopic, a concave glass of the same focal length for each eye will, in general, be found best. A trial may, however, be made of glasses each of a different focal length, if the required difference be not very great.

When, under similar circumstances, the two eyes are in different degrees hypermetropic, convex glasses of different power may in like manner be tried.

When one eye is emmetropic and the other myopic, though the eyes might admit of simultaneous use in binocular vision, a concave glass to the myopic eye would not, in general, be practically useful.

When one eye is emmetropic and the other hypermetropic, a similar remark applies to the use of a convex glass to the latter.

Should there be squint, and the eye in habitual use requires optical assistance, it may be fitted with a glass irrespective of the optical condition of the other.

When, with one eye myopic and the other hypermetropic, there is absence of binocular vision, perhaps squint, the eyes are used alternately.

One gentleman thus affected had divergent squint, and used the myopic eye for reading with—the hypermetropic eye for looking about with.

In such a case each eye in its own sphere requires to be assisted with a glass, the myopic eye with a concave, the hypermetropic with a convex glass.

Another gentleman who had convergent squint was in the habit of using one eye only, and that was myopic. The other eye he always looked upon as useless. The sight of the former eye having failed him, he consulted me. The cause of this failure of sight I discovered to be detachment of the retina. On examination of the other eye I found it to be hypermetropic, but otherwise sound, and quite fit, with the help of two pairs of convex glasses, to take the place of the other—one pair to look about with, another pair of higher power (about six inches focus) for reading with.

Conical cornea.

Defective sight sometimes occurs in consequence of the cornea gradually becoming so prominent in the middle as to be of a conical shape. Short-sightedness first attracts attention, and by and by vision becomes very indistinct at any distance. This is owing to the irregular refraction of the light. Deep concave glasses afford some assistance to vision, but only in the slighter degrees of the complaint.

Astigmatism or Cylindrical Eye.

This, in the most ordinary form, consists in the eye seeing horizontal lines distinctly at a nearer distance than vertical lines, so that in looking at a watch with Roman numerals, for example, the person sees the and the more distinctly than the XII and the VI, whilst at a farther distance he sees the XII and the VI more distinctly. In less frequent cases the eyes collect to a focus on the retina the rays which diverge in a horizontal plane at a shorter distance, and the rays which diverge in a vertical plane at a longer distance.

In still less frequent cases the different foci in astigmatism, instead of being for rays in horizontal and vertical planes, have been met with for rays in oblique planes.

If the astigmatism be slight, vision is not materially disturbed, but if it be in any great degree, the indistinctness of sight is so great as to require the help of cylindrical glasses.

In the form of astigmatism first mentioned a concave cylindrical glass of suitable power, with its axis horizontal, held before the eye, will enable the person to see the IX and the III distinctly at the same distance as he naturally sees the XII and the VI, so that he will now be able to see the figures on the face of the watch equally distinctly all round.

A convex cylindrical lens of suitable power, on the other hand, with its axis vertical, will enable the person to see the XII and the VI distinctly at the same distance as he naturally sees the IX and the III, so that he will now be able to see the figures on the face of the watch equally distinctly all round.

In a case of oblique astigmatism the cylindrical glass would require to be held obliquely before the eye.

For use the other side of the lens is made plane, or spherically convex or concave, to suit the condition of the eye, whether myopic or hypermetropic, irrespective of its astigmatism.

The particular power of cylindrical glass required may be determined by trying a series of cylindrical lenses, both convex and concave, until the proper one is found.

The following mode of calculating will help to an approximation. If a person sees vertical lines distinctly at the distance of fifteen inches, but desires to see them distinctly at the distance of ten inches—the distance, viz., at which he sees horizontal lines distinctly—the focal power of the cylindrical convex glass which he will require is determined thus:

Multiply the two distances of fifteen and ten together, and divide the product, 150, by the difference between them, viz., five. The quotient thirty is the focal length in inches of the convex cylindrical glass required.

If, on the other hand, the person desires to see horizontal lines distinctly at fifteen inches distance—that, viz., at which he sees vertical lines, he will require a cylindrical concave lens the negative focal length of which he will ascertain by a similar calculation.

Convex and Concave Spectacle Glasses.

Convex glasses are distinguished and designated by their focal length. Convex glasses of the lowest power in common use have a focal length of sixty inches, forty-eight inches, thirty-six inches, thirty inches, and twenty-four inches. Those of medium power have a focal length of twenty inches, eighteen inches, sixteen inches, fourteen inches, and twelve inches. Those of the highest power have a focal length of ten inches, nine inches, eight inches, seven inches, six inches, and five and a half inches.

Cataract glasses have a focal length usually of four and a half inches for looking about with, and two and a half inches for reading with.

Reading glass.—This is a double convex lens, used for the purpose of magnifying the object—the names on maps or the like—whereas convex spectacles are used merely to render objects distinct at a given distance without magnifying them, as above mentioned.

Concave glasses have been hitherto in this country distinguished and designated by arbitrary numbers; abroad they are more generally distinguished by their negative focal length—that is, the focal length of the convex glass which with it would form a combination equivalent to a plane.

The following are the numbers and their corresponding focal lengths, as found in the opticians' shops in London:—

No.	Inches.	No.	Inches.
00	36	9	7
0	30	10	6
1	24	11	5
2	20	12	4½
3	16	13	4
4	14	14	3½
5	12	15	3
6	10	16	2½
7	9	17	2¼
8	8	18	2

Cylindrical Lenses.

Convex cylindrical lenses have the form of a segment obtained on cutting a cylinder by a plane parallel to its axis. Concave cylindrical lenses have the converse form, or such as would be produced by grinding on a cylindrical surface.

Two convex cylindrical lenses being placed with their plane surfaces in contact, and so disposed that straight lines parallel to the axis of the cylinder drawn on the convex surface of one may be at right angles to lines similarly drawn on the other, form a combination possessing the same refractive qualities as a common convex lens. Concave cylindrical lenses similarly combined form a lens equal to an ordinary concave.

Convex and concave bi-cylindrical lenses are made by grinding the opposite surfaces of the form and in the relation described. The surface with the vertical axis should be next the eye. If the radius of curvature of one of the cylindrical surfaces be made longer or shorter than that of the other we have an astigmatic lens. But the simplest form of astigmatic lens is that above described in the article astigmatism or cylindrical eye, p. 55.

Prismatic Glasses.

Prismatic glasses are formed either with perfectly plane or in combination with convex or concave surfaces, inclined towards each other at an angle varying from three to twenty-four degrees.

Prismatic glasses are sometimes used to correct the diplopy arising from slight incurable declinations of the visual lines, outwards, upwards, or downwards, or to relieve muscular asthenopy.

CHAPTER III.

CATARACT.

CATARACT is manifested by a grayness or whiteness in the pupil, which is naturally of a clear black, and consists in a greater or less opacity of the crystalline lens. In consequence of this opacity the rays of light are, in a proportionate degree, intercepted on their way to the retina, so that vision is more or less impaired, or even reduced to a perception of light and shade.

Different kinds of cataract are recognised by surgeons, and the distinction of one from the other is a point of no small importance, for on it depends a correct conception of the rise and progress of the disease, and, especially, the discrimination of the operative procedure best adapted to effect a restoration of sight in a given case.

Cataract, as above defined, is sometimes distinguished by the epithet *true* in contradistinction to what has been called *false* cataract, which consists in opaque deposits of lymph, matter, blood, &c., on the crystalline body, obstructing the pupil—the consequence commonly of anterior internal inflammation of the eye. False cataract, however, may be combined with certain kinds of true cataract.

Cataract sometimes already exists at birth, and, like ill-formed teeth, may be viewed as an example of imperfect development. In advanced life, again, cataract is so common that it may be looked upon as, in some degree, a natural degeneration of structure, analogous to the decay of the teeth or whitening of the hair.

Congenital cataract is sometimes met with in several children of the same family—a circumstance which points to some peculiarity in the health of the parents. The children of parents who are first cousins are often the subjects of congenital defects—amongst others, congenital cataract.

The cataract which occurs in advanced life cannot, in general, be attributed to any particular exciting cause, as it is met with in all conditions of life, and under the most varied circumstances. An hereditary predisposition, however, often appears to exist.

Cataract arising in youth and manhood can often not be traced to any particular cause. Sometimes it is owing to inflammatory degeneration of the eye; sometimes it is the result of injury. Diabetes is here also to be named as a cause. That the opacity is, in this case, induced by the direct action of the sugar pervading the system on the lens would appear from the fact that a frog may be rendered cataractous by placing it in sugared water.

Lenticular cataract or opacity of the proper substance of the crystalline lens constitutes the typical example of cataract; and whilst it is the most common kind, it is fortunately that which admits of the most ready and perfect cure.

In older persons the opaque lens is hard; in younger persons soft.

Hard or Common Lenticular Cataract of Old Persons.

From fifty years old and upwards is the age of the majority of persons who present themselves with cataract, and in them the cataract is usually harder in a greater or less degree than the lens naturally is.

When the cataract is pretty fully formed everything right before the patient generally appears to him as if obscured by a thick cloud or gauze. In bright light, which causes the pupil to contract, vision is still more indistinct; in moderate dull light, which allows the pupil to dilate, it is less so. The opposite of this, however, sometimes occurs, viz., that the patient sees as well in a strong as in a weak light, sometimes better. Lastly, objects may not be seen at all, but vision may be reduced to a mere perception of light and shade.

The peculiarities in the state of vision now enumerated present themselves according as the opacity is greater or less in the centre opposite the pupil than at the circumference of the lens, or as it is equally great in the centre and at the circumference.

When the pupil is dilated by belladonna, or its active principle, atropia, vision is still more decidedly improved, as the dilatation produced is greater than that which takes place in dull light.

The dimness of sight and opacity in the pupil in general begin in a very unmarked manner, and increase slowly, for perhaps months or years, until they have attained the degree above described. Usually one eye is affected first, and by and by the other. In rarer cases both eyes become equally affected at the same time.

When once begun to form, it may be prognosticated that the cataract will go on to increase until all useful vision is prevented in the eye. And it may also be prognosticated that the other eye, if not already affected, will become so likewise. How rapid or how slow the progress to loss of useful vision may be cannot, however, be prognosticated—it may be months, or it may be years.

Restoration of vision can be effected only by an operation.

There are various modes of operating, each adapted to the circumstances of the individual case; but all have for their common object the removal of the opaque body from behind the pupil, so that the rays of light may be again allowed to pass on to the retina.

To make up for the loss of the crystalline lens, the use of spectacles, with strong convex glasses, is required after recovery from the operation.

In cases fit for the operation a successful result may be expected in a large majority. Perhaps out of twelve cases operated on excellent sight may be recovered in eight, less good sight in two or three, whilst one or two will prove unsuccessful.

When in one eye useful vision is lost,and in the other vision has become dim from cataract, it is advisable to operate as soon as possible on the blind eye, in order that this may be fully recovered by the time the opposite eye is so blind as to require the operation.

When in an elderly person double lenticular cataract has become so far developed as to interfere with useful vision the operation should be had recourse to as soon as possible, especially if extraction is the operation to be performed, for there is more chance of a successful result than at a later period.

When cataract is fully formed in both eyes both may be operated on at the same time.

Preparation of the patient for undergoing an operation for cataract.—If the case be free from local or constitutional complications the patient requires no other preparation than a few days' rest of mind and body, some attention to diet, and to the state of the bowels. If, on the contrary, any such complications exist, he ought, before the operation is undertaken, to be subjected to such treatment as is adapted either to remove them altogether or to palliate them so far as to remove or diminish the risk of their interfering to prevent the success of the operation. The previous habits of the patient as to diet, the use of strong drinks, smoking, &c., should be carefully considered.

In very timid patients chloroform may be occasionally resorted to, at least in operations with the needle. The vomiting which is apt to supervene is a strong objection to its employment in extraction.

Seasons of the year best adapted for operations for cataract.—Operations for cataract may be performed during mild and steady weather at any season. Very hot and very cold weather are equally unfavorable; cold east winds are especially so.

Removal of the Cataract by Extraction.

In the common hard lenticular cataract of old persons the operation it is most advisable to perform, when circumstances admit of it, is extraction through an incision in the cornea.

The operation is a nice and difficult, though not a painful one, and for its success an otherwise healthy condition of the eye is of great importance. Steadiness on the part of the patient during the operation diminishes to the surgeon the difficulties attending its performance, whilst after the operation it is calculated to promote the healing process and to ward off the occurrence of such accidents as are apt to interfere with that process, and so mar success. On the other hand, among the conditions unfavorable to, or wholly forbidding the performance of, the operation are restlessness on the part of the patient, chronic cough, and difficulty of breathing.

When the case is one of common hard lenticular cataract, and when the other conditions are favorable, the prognosis is good. Recovery of the eye from the effects of the operation sometimes takes place in less than three weeks; but not unfrequently some degree of external, or even anterior internal, inflammation occurs, so that recovery is retarded. In general, convalescence should not be calculated on sooner than from four to six weeks. Sometimes, although the case appeared to be in all respects a proper one, and the operation well and successfully performed, the healing process does not proceed favorably, and sight is not restored.

The operation having succeeded as an operation, more perfect vision is in general obtained by extraction than by any other mode of operating.

After the operation both eyes are to be kept closed, and covered with a proper bandage.

The patient need not be put to bed immediately after the operation unless he desires it, but may recline on an easy chair or sofa until about his usual bedtime. The room should be somewhat darkened, and perfect quietness observed in the house. The patient should refrain from speaking, and endeavour to keep himself as composed as possible. His food should be so prepared as not to require much chewing.

During the night the patient ought to be watched, lest, by turning in bed or rubbing his eye with his hand while asleep, the eye should be injured. A good precaution is to secure the patient's hands to his sides, so far that they may be prevented from being carried to the eyes.

The patient should not go to stool for the next day or two succeeding the operation, if this can be avoided. If not, he ought to bear well in mind to move with the greatest caution, and that he must not make the slightest straining effort. Irremediable injury to the eye, by protrusion of the iris, &c., has been the result of such want of care. After forty-eight hours some laxative medicine may be taken.

The patient should lie on his back, or on the side opposite that on which the operation has been performed, until at least the third day, when, if matters go on well, he may sit up in bed. On the fourth day he may be allowed to get out of bed for a few hours in the afternoon.

During the twenty-four or forty-eight hours succeeding the extraction the patient feels as if he had received a blow on the eye, and also from time to time experiences a slight smarting and pressing sensation, which is always relieved when a watery fluid escapes from the eye. From this and encrusted Meibomian secretion the eye is to be from time to time carefully cleansed with tepid water and a soft linen rag. The eye is not to be opened until the third, fourth, or fifth day; but that things are going on well may be inferred if there is no pain, and the upper eyelid neither red nor swollen. On the third or fourth day, after the borders of the eyelids have been cleansed from any adherent matter by means of tepid water and a bit of soft lint, as just mentioned, and the strips of plaister, if they have been used, removed, the eye may be opened and looked at, but closed again, and so on occasionally, until the ninth or tenth day. After that, the eyes being protected by a shade, the patient may freely open them.

Removal of Cataract by Division.

The object of this operation is to lacerate the capsule and break up the lens, so that the latter, being freely exposed to the action of the aqueous humour, may be gradually dissolved and absorbed, and thus altogether removed from the eye.

Division is the operation indicated in cases of soft or fluid cataracts—forms of the complaint of most common occurrence in early life; but it is also applicable to firm cataracts, such as are met with in persons about and below fifty years of age. It is the usual operation also for *congenital cataract*. See p. 114.

Considered as an operation, division is the most simple of all those for cataract, both in performance and in the extent of injury necessarily inflicted on the eye.

In the cases proper for the operation the prognosis is good. There is in general little inflammatory reaction, but, though the lens may be perfectly absorbed, the capsule, which does not admit of solution and absorption, if not already opaque, may become so, and form what is called *secondary capsular cataract.* The rapidity with which solution and absorption go on varies from a few days to several months. In general it may be said that in children the absorption proceeds more quickly than in adults.

One operation may suffice; but, generally, solution proceeding slowly, the operation requires to be repeated, and that more than once. This, as the operation is so simple and painless, is no great objection. The interval between the repetitions of the operation is usually about a month or six weeks.

It is best to operate on both eyes at the same time. I have observed that solution proceeds more quickly after the operation on both eyes at the same time than after the operation on one eye only.

Secondary Cataract.

After the operation of extraction some portion of the cataractous lens may remain obstructing the pupil, forming what is called *secondary lenticular cataract.* In such a case no interference is in general required, the lenticular fragments being eventually absorbed. The posterior strata of the lens, both opaque and firm, sometimes remain adhering to the posterior wall of the capsule, and show little disposition to become absorbed. In such a case it may be necessary to have recourse to the operation of division after recovery of the eye from the extraction.

After the operation of extraction of the lens, but especially after division, the capsule is liable to become opaque and obstruct the pupil. This forms secondary *capsular* cataract, which admits of removal by a subsequent operation.

Can Cataract be cured without an Operation?

In many cases cataractous patients have their sight temporarily improved by dilating the pupil with belladonna or atropia. Some, however, are dazzled by this. And in some, though benefit is obtained, congestion of the eye is induced, so that it is necessary to discontinue its further employment.

There have been, and there are at the present time, persons who pretend to cure cataract without an operation, and witnesses to their skill are not wanting, either in persons who allege to have been themselves thus cured of cataract, or in persons who aver that they are acquainted with persons who have been thus happily restored to sight.

On the other hand, all medical men of reputation and experience in the treatment of the diseases of the eye affirm that they have never known a case in which true cataract, when once formed, has been cured without operation—that is, in which the lens, having once become opaque, has been again rendered transparent, or at least been removed, either by the efforts of nature or by any kind of medical treatment.

Cataract Glasses.

The difference in refractive power between the air and the cornea being much greater than between the aqueous humour and crystalline body, the greatest amount of refraction which the rays of light undergo in the eye, in order that they may converge to foci on the retina, is that effected by the cornea on their first entrance. The crystalline body contributes comparatively little to the convergency. Hence vision, after a successful operation for cataract, may be *tolerably distinct* for objects at a certain distance. Still, in order that it may be *perfectly distinct*, the use of convex glasses is required.

But as with the loss of the crystalline body there is loss of the faculty of the eye to adjust itself for different distances, except so far as variations in the size of the pupil contribute to this effect, glasses of different degrees of convexity are required according as the patient wishes to view near or distant objects. Thus, convex lenses of about two and a half inches focus are generally required for reading, and lenses of about four and a half inches focus for viewing objects around him.

Of course before fixing on any particular powers the patient will try which suit him best, and the test which should guide him in his choice is that when the spectacles are put on, or, if hand-glasses, when they are held immediately before the eyes, he sees objects distinctly at the same distance as he saw them before he became blind.

Recourse is not to be had to the use of cataract glasses until the eyes have perfectly recovered from the operation, and have been so for some time.

CHAPTER IV.

MUSCÆ VOLITANTES, OR APPEARANCES LIKE MOTES OR FLIES FLOATING BEFORE THE SIGHT.

Muscæ volitantes are described by the patient who has made no particular examination of the appearance as blackish motes, or a thin gray film, like the wing of a fly, or semi-transparent gray threads, like spiders' web; but if viewed attentively against the clear sky, a white wall, or the like, they are recognised to be made up of some such appearances as are represented in the annexed figure.

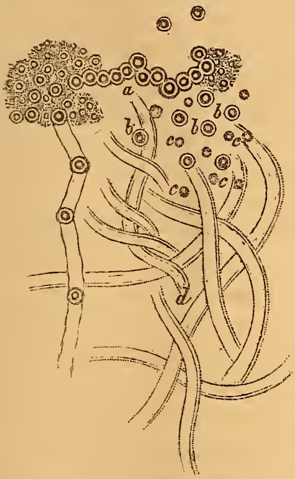
According as the distance of the field against which the appearances are viewed is greater or less, they are seen larger and fainter, or smaller and more distinct.

Vision is not affected by floating muscæ. Between the several portions of the muscæ and by the side of them the eye still sees with perfect distinctness, and after the muscæ have glided out of the field of view everything is clear.

Floating muscæ are to be distinguished from *fixed muscæ*, appearances which have no real motion, but apparent motion only, depending on that of the eyeball. Fixed muscæ are owing to insensible spots of the retina, and belong to the head of amaurosis.

Hitherto a very common opinion as to the nature of floating muscæ has been, that they are sensations, depending on some intrinsic change of state of the optic nervous apparatus, thus confounding them with

FIG. 11.



fixed muscæ; but that they are truly sensations, occasioned by the presence of particles in the interior of the eye and close in front of the retina, throwing their diffracted shadows on that nervous expansion, admits of demonstration.

The particles appear to be of natural occurrence in the eye; for the appearance of floating muscæ may in general be seen by any person on simply looking through a small aperture in a card at the clear sky, or through the eyeglass of a compound microscope at the flame of a candle two or three feet distant, or simply by nearly closing the eyelids and looking at a lighted candle.

Muscæ volitantes are often seen by persons without any particular notice of them being taken, as they are indistinct, present themselves occasionally only, and are therefore not troublesome. They are seen most distinctly, and are therefore most troublesome, when there exists an irritable state of the retina. Such a state of the retina may therefore be viewed as the general condition on which floating muscæ, considered as a disease, depend.

When the person is near or far-sighted they appear less evident to him when he uses the glasses fitted to render his vision distinct.

As exciting causes of the complaint may be mentioned over-use of the eyes, disordered digestion, want of sleep, hypochondriasis, morbid sensibility of the system generally, arising from pressure of business, anxiety, and distress of mind.

When a hypochondriacal person once detects muscæ volitantes he takes such frequent notice of them that they become to him more and more troublesome.

From what has been said, it will be seen that the occurrence of floating muscæ is of itself no indication that either cataract or amaurosis is taking place. If, however, there be along with the appearance of muscæ a failure of vision, and if that failure be not attributable to myopy or presbyopy, which may be ascertained by a concave or convex glass not improving the sight, then cataract or impaired sensibility of the retina may possibly exist.

As floating muscæ depend on the vision of objects naturally existing in the eye, and are distinctly observed only in consequence of a morbid sensibility of the retina, whatever tends to promote or relieve this will have the effect of promoting or relieving the muscæ.

The removal or abatement of the exciting cause, if it can be detected, is the first thing to be looked to in the treatment. Rest to the eyes, if they have been overstrained, relaxation from business, quiet to the mind, regulated diet and exercise, with change of air, are to be recommended. Bathing of the closed eyes with cold water two or three times daily, for five or ten minutes, is the most important local application.

CHAPTER V.

AMAUROTIC AFFECTIONS, OR DEFECTS OF SIGHT DEPENDING ON PERVERTED, IMPAIRED, OR LOST SENSIBILITY OF THE OPTIC NERVOUS APPARATUS.

Abnormal excitement of Visual Sensations.

In amaurotic affections, various visual sensations, though not in themselves unnatural, are liable to be excited unnaturally. Such sensations being important as symptoms, it is necessary to study them; but, previously to doing so, the circumstances attending their natural occurrence must in each case be taken into consideration.

Photopsy and Chroopsy, or sensations of light and colour, independently of external light.

In the unexcited condition of the optic nervous apparatus, there is darkness before the eyes, but in the excited condition, the sensations of light and colour are experienced.

The sensation which we perceive in consequence of an impression on the eye, we denominate *light;* and the external agent, which commonly makes the impression, we also call light. But the sensation, and the external agent which by its impression on our eye excites in us the sensation, are totally different things. The external agent, light, considered in itself, is not clear, nor yellow, nor red, nor blue; it is merely the undulations, different in size and rapidity, of a universally distributed and excessively tenuous imponderable ether.

That the sensation of light depends solely on the peculiar energy of the optic nerves, and not on the nature of the agent which impresses them, is proved by the fact that the sensations of light and colour may be called forth by other influences than light, such, for example, as pressure.

A familiar example of a luminous spectrum of the kind under consideration is that which, on pressing the eyeball, is seen projected outwards, and on the side opposite to that where the pressure is applied.

In further illustration of the excitement of the sensation of light by other agencies besides the agent properly called light, and how apt people are to mistake the former for the latter, the following case is adduced:

Some years ago, in Germany, a clergyman was assaulted one dark night by two men, one of whom struck him on the right eye with a stone. By the light which streamed from his eye, in consequence of the blow, the clergyman averred that he was enabled to see and identify the man who committed the outrage.

The question whether this was possible was actually raised in the criminal investigation, and the official district physician was referred to for his opinion. That gentleman, without fully admitting the possibility of what the clergyman maintained, still thought that there might be some probability in it.

The late Professor Müller, the distinguished physiologist of Berlin, commenting on this singular case, sarcastically but justly observed, that if the district physician had pressed on his own eye in the dark, and tried to read by the light thereby emitted, he would probably have come to a more decided conclusion.

It is indifferent what part of the optic nervous apparatus be excited in order that luminous sensations may be perceived—whether the retina itself be irritated, the fibres of the optic nerve in the orbit irritated or cut, or whether the cerebral part of the optic nervous apparatus be pressed on by congestion or tumour. Moreover, in whatever part the optic nervous apparatus be excited, the sensation which results is always referred by the sensorium to without the body. This faculty of perceiving outness, is, it may be remarked, dependent on an original connate law of our minds, and not on experience through the touch. That sensations of touch itself, even, may be referred by the mind to without the body is shown by the well-known fact, that persons who have had the misfortune to lose a limb, sometimes feel as if the lost organ were still in connection with the body, and that some part of it, perhaps, is the seat of pain. Thus, to quote from the 'Spectator': "The poor fellow who lost his arm last siege, will tell you, he feels the fingers that were buried in Flanders ache every cold morning at Chelsea."

Though the changes operating on the brain, whereby we are rendered conscious of sensations, are usually the result of the communication of impressions on the nerves of sense made by external agents, such changes in the state of the brain may be the result of the communication of changes in the state of the nerves of sense induced by impressions made by some agency operating within them, or they may be primarily induced by some cause directly operating within the brain itself.

Examples of this are—a spectrum of the vessels of the retina, *light on a dark ground*, which, in certain states of the eye, is seen, and which is owing to pressure on the retina by its vessels in a state of congestion; the appearance of a shower of lucid globules before the eyes on suddenly rising from a stooping posture, from the disturbance in the circulation in the optic nervous apparatus thereby occasioned.

Analogous appearances of fiery scintillations, flashes of light and coloured corruscations, occurring spontaneously, are symptoms of irritation or excitement of some part of the optic nervous apparatus—cerebral or ocular—from inflammatory congestion. As such inflammatory congestion may end in amaurosis, so the luminous and coloured spectra are symptoms of incipient amaurosis. They may continue to appear, however, after all visual sensibility is lost.

Sensations of light from such a cause operating within the body may be mistaken by ignorant or weakminded persons for sensations actually excited by light, as in the following case:—

A woman deaf for some years, and troubled with noises in her head, became subject to photopsy also; and fell into the hallucination of supposing that people had everywhere conspired to annoy her by throwing glares of light into her eyes. I found it impossible to convince her of the real nature of her complaint. Her intellect was evidently impaired from the same disease of the brain to which the noises in the head and the photopsy were owing.

Spectra from the retention of visual sensations.—Complementary colours.

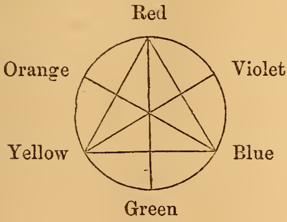
In the natural state, the sensations of the retina remain a short space of time after the impression which occasioned them has ceased to act. Hence, an image of an object may continue to be seen for some seconds after the eyes have been turned away from looking at it. This phenomenon is, in general, most readily observed in twilight; in daylight, the impression of the object on the retina requires to have acted more intensely and a longer time to produce the effect.

The spectrum is seen differently, according as the eyes, when turned away from the object, are darkened or directed to an illuminated surface. In the former case, the lights and shadows are the same as appeared at the time of regarding the object (*positive spectrum*); in the latter, they are the reverse (*negative spectrum*).

If the object from which the impression has been derived is coloured, the negative spectrum is coloured also, but differently, thus :—If the eye be fixed on a red-coloured object for some time, and then turned away from it, a spectrum of the object will continue to be seen, but instead of a red, of a green colour. If, on the contrary, the object looked at be green, the spectrum will be red; again, if blue, the spectrum will be orange; if orange, the spectrum will be blue; if yellow, the spectrum will be violet; if violet, the spectrum will be yellow.

From this it is seen that the colour of the negative spectrum is always that which, being added to the colour of the object looked at, makes up the sum of the prismatic colours, yellow, red, and blue, which, by their combination, form white light; hence the name *complementary* which has been given to the colour of the negative spectrum.

In the annexed figure the colours, yellow, red, and blue, are placed at the angles of the triangle, the compound colours, orange, violet, and green, at the intermediate points. The primitive colour and the compound one, which thus stand opposed, viz., yellow and violet, red and green, blue and orange, are complementary of each other.



In certain morbid states of the retina, even although vision be much impaired, the sensation remains after the impression a much longer time than natural; hence arise illusions of vision from the spectrum and complementary colours. In such a case, for example, if the person, after his eye has rested on some small and near object, the tassel of a blind for example, should accidentally look towards the sky, he will there see projected an image of it magnified and of a reverse tint or colour; but, not aware of the cause, he may be alarmed by what appears to him a gigantic human figure in the air.

Spectra from the retention of visual sensations have, no doubt, constituted the foundation of many stories of apparitions.

Phantasms.

Besides spectra from after-visual sensations, there is another class of apparitions, which have their origin in the reaction of the mind on the senses. To this class belong *phantasms.*

Phantasms of touch are exemplified in the pains of hypochondriacs. In regard to phantasms of hearing, people sometimes imagine that they hear not only sounds, but spoken words. The phantasms of vision are those, however, which have attracted most interest. Appearances as if of various objects—landscapes and figures, for example, even walking figures—present themselves before the eyes. Nay, phantasms of both hearing and vision may occur together—the human figures seen being, at the same time, heard talking. In the celebrated case of Nicolai, the Berlin bookseller, the phantasms were at first *seen only*, but after a time they were *heard also.*

Phantasms are of most common occurrence in disease, under the influence of opium and other narcotics, in drunkards' delirium, and in insanity; but they may appear to persons otherwise healthy, though in an excited state either from original temperament or in consequence of being placed in exciting circumstances. And, of course, exciting circumstances will operate more strongly on a person already excitable from original temperament. In some persons there is a natural disposition to phantasm-seeing.

The mental state excited by some strong impression or by long brooding on a cherished scheme may, by its reaction on the senses, give rise to a vivid production of phantasms relating to the predominating idea.

This is exemplified by Shakespeare, when he makes Macbeth exclaim—

"Is this a dagger which I see before me,
The handle toward my hand? Come, let me clutch thee.
I have thee not, and yet I see thee still."

We have a similar example in Brutus—"midst his slumbering host, startled by Cæsar's stalwart ghost."

Phantasms occurring in persons of strong mind and cultivated intellect are recognised as such. This was the case with Nicolai, already referred to. The arguments used by the epicurean Crassus, to tranquillise the mind of his friend Brutus, after being startled by the apparition of Cæsar, showed that he took a correct view of the matter, attributing the phenomenon solely to the imagination; and Shakespeare makes Macbeth raise the question, when he adds to his first exclamation—

"Art thou not, fatal vision, sensible
To feeling, as to sight? Or, art thou but
A dagger of the mind; a false creation,
Proceeding from the heat-oppressed brain?"

In the case of persons of uncultivated intellect phantasms have, no doubt, been the origin of many ghost stories, whilst in weak-minded persons, not otherwise actually insane, they may lead to hallucinations prompting to insane actions.

Every one has heard of the phantasms induced by the use of opium, and the still more remarkable ones excited by Hashish or Indian hemp, the drug said to have been used by the sect of Assassins (under the blow of one of whom Conrad, Marquis of Montferrat, one of the leaders of the Crusaders, fell) to raise phantasms, and thereby incite themselves to their violent deeds —hence the name Assassin—those who indulge in the use of Hashish being to this day called in Arabic Hashishin or Hashashin.

The occurrence of phantasms in insanity has been mentioned, but it would be out of place here further to refer to them.

I come, in the last place, to notice the phantasms on which has been founded a belief in "second sight."

That kind of second sight referred to by Campbell in the following lines:

> "'Tis the sunset of life gives me mystical lore,
> When coming events cast their shadow before,"

is, after all, a natural enough kind ot second sight, and one which we all acquire more or less by the experience of life.

Persons said to have been endowed with 'second sight' among the Scotch Highlanders appear to have been of excitable temperament and deeply contemplative character. Alan Macaulay, in Sir W. Scott's 'Legend of Montrose,' is a good example. Such a person, having his mind intently and anxiously fixed on some stirring enterprise, may readily be supposed, when wrought up to a paroxysm of excitement, to have had presented to his mind's eye, and with all the distinctness of reality, a possible combination of events. In any case, when the events turned out in the combination predicted by the seer the vision was received as supernatural, and the case was treasured up in the memory of those concerned. But when the events did not correspond to the prediction, the failure, as generally happens in unsuccessful cases, was unnoticed and forgotten.

Impairment and Loss of Sensibility of the Optic Nervous Apparatus, or Amaurosis in its Various Degrees.

The sensibility of the retina is greatest in the middle; from thence it diminishes towards the circumference.

In consequence of this, we see only that part of an object very distinctly to which the axes of the eyes are at the moment directed. In examining an object, therefore, the axes of the eyes are so moved that the central region of the retina may be successively impressed by the image of its different parts.

The difference in the degree of sensibility of the middle and circumferential parts of the retina may be illustrated by a reference to the difference in the degree of sensibility of the skin of the lips, for example, and the skin of the cheeks. If the points of a pair of compasses, separated a very short distance from each other, are applied to the skin of the lips, the mind distinguishes the two impressions; but if applied to the skin of the cheek there is no distinct perception of two points, but a sensation as if one impression only were made.

Daltonism, or Colour-blindness.*

Cases occur, and that more frequently than is generally supposed, in which persons are unable, in different degrees, to distinguish certain colours, their sight in other respects being natural. The colours most generally confounded are red and brown with green, and pink with blue. Yellow and blue are generally readily distinguished by the colour-blind.

The affection appears to be in most cases congenital.

Acquired colour-blindness, however, sometimes presents itself as a symptom of incomplete amaurosis. Yellow discoloration of the humours of the eye I have found not to interfere with the correct perception of colours.

Colour-blindness has been met with much oftener in males than in females. It runs in families and, like other hereditary complaints, sometimes overleaps one generation or more.

The most important practical disadvantage attending it is, as has been pointed out by Dr. Wilson, the possibility of confounding red and green signals on railways or at sea, a mistake which might entail most disastrous consequences.

---

* So named from Mr. Dalton, the author of the atomic theory in chemistry, who had the defect of sight in question, and was among the first to write on the subject. See 'Memoirs of the Literary and Philosophical Society of Manchester,' 1798.

Congenital colour-blindness is incurable. One method by which the false judgments of the imperfect sense may be corrected is the *comparison of doubtful with known colours*, by carrying about a chromatic scale, accurately tinted and named. This, however, is available only to a limited extent—that is, as far as the colours of the scale itself can be distinguished.

Transient Hemiopy, or Half-vision.

The following is an account of hemiopy, by Dr. Wollaston, as it occurred in his own person:—" I suddenly found, after violent exercise, two or three hours before, that I could see but half the face of a man whom I met; and it was the same with respect to every object I looked at. In attempting to read the name JOHNSON over a door, I saw only . . . . SON; the commencement of the name being wholly obliterated to my view. The loss of sight was towards my left, and was the same whether I looked with the right eye or the left. This blindness was not so complete as to amount to absolute darkness, but was a shaded darkness, without definite outline. The complaint was of short duration, and in about a quarter of an hour might be said to be wholly gone, having receded with a gradual motion from the centre of vision obliquely upwards towards the left."

In some persons such an attack is not infrequent, coming on along with indigestion, headache, and nausea, but going off in a few hours.

According as hemiopy depends simply on fatigue or gastric derangement, so must the treatment be regulated and the means adopted to prevent its recurrence.

Common amaurosis sometimes presents itself as a hemiopy, in which case it may be the *right* side or the *left* side of the field of view, or the *upper* half or the *lower* half, which is obscured; and so far from coming on suddenly and going off suddenly, this form of hemiopy comes on slowly and continues gradually to extend until the whole field of view is obscured, and that, perhaps, incurably.

Night-blindness.

Indistinct vision, recurring regularly at night, has sometimes prevailed as an epidemic. Most frequently it is met with as an occasional complaint, especially in warm countries and warm latitudes at sea. In certain countries it appears to be endemic, occurring in the spring and summer.

The principal causes of night-blindness appear to be fatigue and exposure to the strong light of the sun and gastric derangement; lunar influence is also considered to operate as a cause. I have met with two cases apparently arising from exposure of the eyes to naphtha vapour.

The occurrence of night-blindness in connection with scurvy, which had been before noticed by authors, was repeatedly exemplified among the soldiers and sailors in the Crimea; and in the last American edition of my treatise on 'Ophthalmic Medicine and Surgery' it is stated that those who have had the care of soldiers since the commencement of the civil troubles in the United States, can bear witness to the fact that night-blindness has been not infrequent in cases of scurvy.

Under proper treatment, the prognosis, in cases of the occasional form of the complaint, may be always favorable.

Europeans who have been once affected with night-blindness are particularly liable to a recurrence of the complaint as long as they remain in tropical climates.

Night-blindness is sometimes met with as a congenital and habitual infirmity. It may affect more than one member of the same family. A most remarkable history of hereditary night-blindness, which has prevailed in one family for two centuries, has been recorded.

Persons thus affected, it has been remarked, have been, many of them, the offspring of parents who were first cousins. Two sons of one family of my acquaintance, the parents of whom were related in this degree, were affected with deafness in addition to night-blindness. One of them, moreover, died of consumption and the other lost his leg from disease of the knee-joint.

With the advance of life the visual field contracts, and the blindness may, at last, become so great that the persons find a difficulty in going about by themselves.

Amaurosis.[*]

Amaurosis is impairment or loss of sight from disease of the retina, optic nerve, or part of the brain with which the optic nerve is connected. If the retina only be affected, it cannot receive the impression which should be transmitted by the optic nerve to the brain;—if the optic nerve only be affected, it cannot transmit the visual impression from the retina to the brain;—if that part of the brain with which the optic nerve is connected be alone affected, the sensorial power to take cognizance of the visual impressions transmitted by the optic nerve is lost.

Thus, the general result is the same, whether the different parts of the optic nervous apparatus be affected together or separately.

The *symptoms* of amaurosis are very various and inconstant.

As to the immediate *causes*, they are morbid conditions of the optic nervous apparatus, differing both as regards nature and seat.

Amaurosis must not be considered as a special disease, but merely a symptom of different affections of the optic nervous apparatus. Each particular case of amaurosis must, therefore, be specially studied by the medical man in reference to its causes, diagnosis, prognosis, and treatment.

For this purpose, exploration of the interior of the eye by means of the *ophthalmoscope* is necessary.

---

[*] Gutta serena of the Arabians, in contradistinction to *gutta opaca,* the name they gave to cataract.

Glaucoma.

This form of amaurosis is so named from the appearance of a sea-green opacity behind the dilated pupil.

The failure of sight in chronic glaucoma presents itself in various degrees, from that in which the patient's attention is drawn to his eyes only by experiencing an occasional dimness of sight, by seeing luminous spectra on stooping, perhaps more readily than usual, and by a feeling of fulness in the globe, to that in which the sight is very much impaired or altogether lost—in which luminous spectra may notwithstanding still be seen, and in which there is pain in the eyeball and around the orbit.

The various organic alterations in the eye on which the subjective symptoms in chronic glaucoma now recapitulated depend take place more or less gradually ; and it may be, perhaps, only after many months that the extreme stage of development is attained. The acute form of glaucoma, on the contrary, is of sudden invasion and rapid development, though, be it remembered, that the affected eye may not have been for some time previously altogether sound, nor the patient's general condition satisfactory.

At the commencement of an attack of arthritic posterior internal ophthalmia, or acute glaucoma, there is often vomiting. The vascular injection of the eye, both sclerotic and conjunctival, is great, and of a purplish tint. There is excruciating pain all over the side of the head. The sight rapidly fails, and may perhaps be lost in a single night. The cornea is dim and rough, and the other characters of glaucoma present themselves in an exaggerated degree.

Though the claim which has been set up for iridectomy as an unconditional cure for glaucoma is not well founded, the operation proves a useful auxiliary in the treatment of arthritic posterior internal ophthalmia, or, as it has been called, acute glaucoma. In chronic glaucoma the result of iridectomy is much less favorable.

In the premonitory stage of glaucoma, iridectomy has been especially recommended as a prophylactic of the threatened mischief.

CHAPTER VI.

DEFECTS OF SIGHT DEPENDING ON LOSS OF CORRESPONDENCE OF THE SENSATIONS AND MOVEMENTS OF THE TWO EYES.

As an introduction to the present subject, the correspondence which naturally exists between the sensations and movements of the two eyes requires to be taken into consideration.

Single Vision with Two Eyes.

As the rays of light emanating or reflected from the different points of a visible object proceed in all directions and in straight lines, those from the same points must necessarily some of them enter the one eye and some the other, and so impress both retinæ in the same manner and at the same time. From these two impressions, it is to be observed, we have not a double perception of the object, but only a single one, provided the eyes be naturally directed.

When the two eyes are thus naturally directed the parts of the two retinæ which receive similar and simultaneous impressions from the rays of light entering them from a given point of the object are their vertices, and their various parts equally situated in relation to them, on the half of one retina next the temple and on the half of the other next the nose. These parts of the two retinæ, as similar and simultaneous impressions on them yield but a single visual perception, are called *corresponding or identical parts.*

If the two eyes are not directed in the manner above described, the rays of light from given points of the object will not then fall on corresponding parts of the two retinæ, and the consequence will be that the two impressions will be perceived by the mind separately, and the object will be seen double.

Amidst the various movements of the eyeballs, the correspondence in their direction necessary for single vision is maintained by the concurrent action of their muscles.

Visual Perception of the Three Dimensions of Space, Length, Breadth, and Thickness.

By the combined action of the two eyes we are enabled to perceive at one glance the length, breadth, and thickness of objects. This is owing to the position of the two eyes in the head, by which each is fitted to receive on its retina a different perspective picture of the object in a manner analogous to that in which, with two fingers, we can receive impressions from two sides of a solid body, so that we recognise its thickness as well as its length and breadth, whilst the mind, in conformity with an original connate law of the economy, does not perceive two superposed dissimilar images, but only a single one, and that, unlike either of the perspectives, in full relief or intaglio, as the case may be.

The stereoscope shows this.

The faculty of perceiving the three dimensions of space with the two eyes implies the faculty of recognising the distance and position of near objects by the same means.

Whilst with the two eyes objects and their several parts are seen fixed, as it were, each in its own position and at its own distance, the same is not the case with one eye. We cannot, for instance, with one eye only so perceive position and distance as to be able accurately to pour wine into a glass, snuff a candle, or perform the like operation. Persons who have lost an eye, therefore, ought to be very careful in all their movements, in order to guard against a false grasp or a false step.

Diplopy, or Double Vision with Two Eyes.

It is to be observed that double vision with two eyes is altogether different in its nature from the manifold vision with a single eye above considered (p. 52). A case of double vision with two eyes is at once distinguished by closing one eye, when objects will be seen single.

This form of diplopy is the result of loss of the natural correspondence in the direction of the two eyeballs, owing, most frequently, to paralysis of some one or more of the muscles moving them.

The relative position of the two images seen in double vision depends upon the direction and degree of the deviation of the eyes. Thus, when one eye is turned inwards its image is on the same side (*homonymous diplopy*); when turned outwards it is on the opposite side (*crossed diplopy*). Again, the two images are seen side by side at a greater or less distance from each other when the deviation depends on paralysis of the internal or external straight muscle; one above the other when the deviation depends on a non-correspondence in the action of the superior or inferior straight muscle; one appearing obliquely placed in respect to the other when the superior oblique is paralysed.

As the deviation of the eyes exists only when the person looks in particular directions and at certain distances, so does the double vision in such cases take place only when the patient looks in those directions and at those distances.

Paralysis of the Muscles of the Eyeball and Eyelids.

It sometimes happens that a person is seized with inability to open one eye. When, in such a case, the upper eyelid is raised with the finger it will perhaps be seen that the patient, though he can turn his eye towards the temple, cannot look inwards, upwards, nor downwards with it. If he attempts to look forward or to the unaffected side, the patient sees objects double, in consequence of the non-correspondence of the two eyes, and he is liable to become giddy if he tries to walk while he holds the eye open.

In addition to the defects in the moving power of the eyelids and eyeball just described, there may be persistent dilatation of the pupil, with impairment of sight, depending on disturbance of the adjusting power of the eye.

Many such cases come on under the same circumstances as rheumatism, viz., exposure to cold and damp, and admit of being perfectly cured by timely treatment.

Sometimes the paralysis is of a more serious nature, being owing to disease within the skull.

Cases of paralysis of the muscle which turns the eyeball outwards are of rarer occurrence than the preceding. There is no accompanying falling down of the upper eyelid; hence the double vision arising from the non-correspondence of the two eyes when the patient tries to look towards the side affected is more felt.

This palsy is more tedious of cure than the preceding.

Another form of paralysis is that in which the eyelids cannot be shut. In such cases all the corresponding side of the face is usually more or less paralysed.

These different classes of cases require early medical treatment.

Strabismus, or Squint.

Strabismus, or squint, is owing to want of harmony in the movements of the eyes, not to actual loss of motive power, for the squinting eye becomes straight and capable of being directed to any object when the other eye is closed.

The principal forms of strabismus or squint are the *convergent* or *inward* and the *divergent* or *outward*, and of these the former is by far the most frequent.

Very commonly convergent squint has its origin in early life. It not infrequently affects several members of the same family, and has therefore appeared to be in some measure hereditary. But it is hereditary only inasmuch as hypermetropy, on which it so often depends, is hereditary.

Prevention and Corrective Treatment.—It is scarcely necessary to say that whatever prompts to a habit of misdirecting the eyes, whether imitation, trying to look at objects too near the eyes, or otherwise disadvantageously placed, careless employment of the sight, and the like, must be carefully guarded against.

Exercise of the habitually misdirected eye during two or three hours daily, by covering the other eye, has often been found successful in curing squint. But it is apt to happen that, whilst the habitually misdirected eye becomes straight, the previously well-directed one turns in.

When convergent squint has become fully established it resists, as is well known, all treatment such as that above indicated, and no other help remains but the operation.

Operation.—This consists in division of the affected muscle, is not very severe, and is quickly recovered from.

Section of the internal straight muscle of the habitually misdirected eye alone may be sufficient, but section of the internal straight muscle of both eyes is generally necessary, as it is found that, if one eye only is operated on, it either still remains inverted, or if it is rendered straight, the previously well-directed eye is apt to turn in.

The latter circumstance is analogous to that above pointed out, viz., that when the previously well-directed eye is covered, and the habitually inverted one, by being thus called into exercise, becomes straight, the former turns in.

In general, little treatment is required after the operation. It is, however, always advisable to keep the patient at rest for some days.

Should a return of the squint take place, the operation may be repeated. Sometimes success has been obtained only after a second or third repetition.

After the operation, the patient should be forbidden to look at near objects at all for some time, and when he does so, to use convex glasses. Hypermetropy having had some connection as a cause with the squint originally, it will be necessary for the patient to use suitable convex glasses for reading with, or otherwise exercising the sight on near objects, if not also for looking at more distant objects.

Squint in which the misdirection of the eye is outwards is rare.

While convergent squint usually occurs in childhood, divergent squint most frequently does not come until a later period of life. This is connected with the later development of the myopy, on which the deviation appears to depend; for as convergent strabismus is in a large proportion of cases combined with hypermetropy, so divergent strabismus is often combined with myopy.

Section of the external straight muscles is the operation required.

CHAPTER VII.

CHOICE OF LIGHT FOR WORKING BY, THE USE OF EYE-SHADES, AND GENERAL PRECAUTIONS TO BE OBSERVED IN THE EMPLOYMENT OF THE SIGHT.

Choice of Light.

We know by experience that a certain moderate intensity of illumination is that by which we can see objects at once most distinctly and most comfortably.

Strong light confuses the vision at the same time that it dazzles the eyes, determines the blood to them, and excites a flow of tears. It is only after some time, perhaps, that the eyes recover themselves. If the light has been very intense—the direct light of the sun concentrated, for example—the spot of the retina impressed may remain affected by it even to insensibility.

The attempt to exercise the sight by too weak illumination, on the other hand, strains and fatigues the eyes in a manner scarcely less injurious.

It is daylight alone which affords that degree and kind of illumination of objects which we find most agreeable to the eyes, and by which we can longest and with the least fatigue exercise the sight.

Our own natural feelings—a good monitor to be guided by in regulating the quantity and quality of the light to which the eyes are exposed—warn us that work at all trying to the sight is best done by day. And to have daylight as long as possible for our work, we should follow the primitive fashion of rising with the sun. Work requiring least exertion of the vision may be done by artificial light. Students and others, therefore, who have to read and write much, should read by day and write in the evening. In like manner, seamstresses should do fine and dark-coloured work by day, and coarser and lighter-coloured work by candle-light.

The window by which we read, write, draw, sew, or do any other such work should look towards the north rather than towards other directions. And the desk or work-table should be so placed that the light from the window may fall obliquely from above, behind, and over the left shoulder, on the book, paper, or work. By this arrangement the light does not fall directly into our eyes, nor is it reflected directly back from the object into them.

We ought never to exert the sight with the sun shining on the work.

As working in too weak a light is as injurious to vision as working in too strong a light, we must not continue poring over the book or seam when the light of day fails so that it is necessary to hold the object nearer in order to see it.

Glaring and flickering lights irritate the eye even when not employed in any examination; but when so employed such light is extremely detrimental. We should not read, write, draw, sew, or the like, under the shade of a tree for any length of time, as every now and then, in consequence of the motion of the leaves by the wind, streams of bright light alternately with shadows fall irregularly on the paper or seam.

Artificial lights of all kinds are much inferior to daylight. The mild diffusion of the latter, with the necessary intensity, uniformity and steadiness, can be but imperfectly imitated in artificial light, which is usually either too concentrated or too weak and unequal and flickering in comparison. And then in respect to quality, what a difference is there to the eyes between working in the clear colourless light of day and the dingy red and yellow light obtained by combustion, to say nothing of the heating and deterioration of the air which result therefrom.

To improve the colour of artificial light, contrivances are adopted to make the relative proportion of blue, yellow, and red rays, something like what exists in daylight. By surrounding the flame with a conical blue reflecting shade, the blue rays thereby reflected downwards mingle with and temper the rays directly radiating from the flame, so that the light received on the work more nearly resembles daylight in colour, while its illuminating power is not only not diminished but is actually increased. This advantage does not attach to the method in which the flame is surrounded by a bluish-coloured glass chimney, for though the light in its transmission is thereby deprived of much of the yellow and red rays, its illuminating power is by so much impaired.

When we use artificial light for working by, it should be, as far as possible, sufficiently bright without being dazzling; and, above all things, uniform and steady.

For reading, writing, or sewing, the light yielded by two composite candles is, perhaps, the best. The light is sufficient in quantity, and, at the same time, mild and not very much coloured; and if there be no draughts of air in the apartment, sufficiently uniform and steady. The candles should be placed to the left of the desk, and a little in front. They ought not to be placed directly in front, and still less brought between the eyes and the object looked at, as is sometimes done by far-sighted people. Their flame should be a little above the level of the eyes.

We ought never to attempt reading, nor indeed doing anything by the flickering light of a fire. Open cooking fires are bad for the eyes, both by their blinding light and radiating heat.

The use of Shades, Tinted Glasses, &c.

It is best to wear a shade like a bonnet front in order to protect both eyes, even though one only is particularly complained of. A good material, both as regards thickness and colour, wherewith to make a shade, is either common brown paper or the slate-coloured paper in which sugar loaves are wrapped; being cut into shape, it is secured round the head by tape or elastic band. In making a shade covered with gray or green silk, the foundation should not be pasteboard, but merely brown paper. Out of doors a broad-brimmed hat or large-fronted bonnet affords a good shade for the eyes.

The gauze shades, closed in all round and below, are good for protecting the eyes from dust; they have, however, the disadvantage that in looking through them the attention is every now and then attracted by the threads of which the gauze is composed, whereby irritation of the eyes is kept up by the involuntary efforts of adjustment.

The best tint of glass for protecting spectacles is that named "London-smoke." The object being to diminish the glare of light, not to alter the colour, such glasses, it is to be remembered, are not to be worn when the sight is to be particularly exerted on any object. To protect the eyes from side glares, spectacles are provided with side glasses, but gauze answers the purpose and is less heavy.

Spectacles, with the glasses set in cups of wire gauze, are, in some cases, useful, but as they are liable to render the eyes too sensitive, both to air and light, their use ought not to be long persisted in.

Care in the Employment of the Sight.

Much exertion of the eyes operates more prejudicially to the sight under some circumstances than under others. Exertion of the sight is especially prejudicial immediately after a full meal, after the use of spirituous drinks, while smoking, when the body is in a recumbent or stooping posture, when dressed in tight clothing, especially tight neckcloth, tight corsets, and even tight boots or shoes, in close ill-ventilated apartments lighted with gas, after bodily fatigue, during mental distress, late at night when sleepy, after a sleepless night, while the bowels are much confined, during convalescence from debilitating illness. Though during recovery from severe disease the eyes cannot bear much exertion, yet, for want of other employment, it is not uncommon for convalescents to read even more than when in health. Many persons have very much injured their sight in this way.

Patients confined to bed are apt, from mere listlessness, to tire their eyes in tracing the pattern of the bed-curtains, or of the paper-hangings on the wall.

Reading in bed by daylight is injurious, but still more so is reading in bed by gas- or candle-light. The eyes are very much strained. The practice is especially prejudicial when one is weak after illness. Very obstinate failure of the adjustment of the eye, with pain, in a lady, was brought on by reading in bed during her confinement.

Reading and Writing.—When the health is naturally good, or care is taken of it, and attention is paid to the precautions above mentioned, the eyes will continue to stand exertion in reading and writing very well. In some cases, however, continued reading and writing, especially by artificial light, proves very hurtful to the sight, and reading more so than writing.

When the sight becomes dim, after long-continued work, do not increase the light, but rest the eyes.

When we have to read much, we should not read very quickly. Reading a novel is more fatiguing to the sight than reading an historical narrative or scientific work, because in the former case we read faster; whereas, in the latter, thinking alternates with the use of the eyes in reading. Reading from a broad page with the lines long and the print small is very tiresome, as it is difficult for the eye always to take up the next line.

Writing down one's own thoughts, or to dictation, requires comparatively little exertion of the sight, not more than to see to place the words in proper order on the paper.

Copying is more trying to the eyes than even reading, as it is both reading and writing and looking backwards and forwards in addition.

It is not good to read or write at a flat table so as to be compelled to stoop. An elevated desk is better, especially one at which the student stands.

It is very trying to the sight to read when driving in a carriage, or when walking, as, on account of the constant motion, the eyes are compelled every moment suddenly to alter their adjustment. If there be sunshine, the circumstances are still worse, for at one time the page may be shaded by the body, and at another, in consequence of a change of position, it may be brightly illuminated by the light falling directly on it.

In the course of a long journey it is better to suffer *ennui* than strain the eyes by reading.

CHAPTER VIII.

GENERAL PRECAUTIONS TO BE OBSERVED IN CASES OF INFLAMMATION, INJURIES, ETC., OF THE EYES, AND IN THE USE OF EYE-WATERS, ETC.

Ophthalmia, or Inflammation of the Eyes.

The eyes are liable to be very materially injured in their structure by inflammation, and the sight correspondingly impaired or destroyed. The cornea may be left more or less opaque—the pupil closed or contracted—the retina more or less insensible to the impression of light.

Without having suffered such a degree of injury, the eyes may, nevertheless, be left, by repeated attacks of inflammation, so irritable as to be incapable of use.

The practical advantage of being acquainted with the causes of inflammation of the eyes is to know how to avoid them, and thus to prevent the inflammation; or if they have already produced inflammation, to know how to remove them, if still in operation and removable.

The causes of inflammation of the eyes may be referred to three heads.

To the first head belong—injuries of the eye; exposure to wind and cold; direct action of very strong light, or of this and strong heat together; over-exertion of the sight, especially in bad light, either too weak or too strong, with much stooping of the head; the direct influence of acrid vapours and contaminated air; epidemic or endemic influences; the direct application of contagious matter.

These are all exciting causes, but some of them require to be assisted by other causes, so that they operate partly as predisposing causes also.

To the second head belong diseases of the skin, especially the exanthematous diseases, as smallpox, measles, scarlet fever.

To the third head belong scrofula, rheumatism, gout, &c.

In the treatment of inflammation of the eyes, the first points to be attended to by the patient (besides, as a matter of course, the removal of the exciting cause, if still in operation and removable) are the protection of the eyes from everything which can cause or keep up irritation—such as using them or exposing them to strong light, and the avoidance of whatever is calculated to operate injuriously on the system in general, such as exposure to the weather, excessive corporeal exertion, errors of diet, &c.

In some inflammations of the eye there is great intolerance of light; in other inflammations there is little or none at all. When the intolerance of light is great, the patient may be kept in darkness. But it is to be borne in mind that long exclusion of the light renders the eyes unduly sensitive. During convalescence, therefore, even though the eyes be still more or less impatient of the light, the room occupied by the patient should not be quite darkened. It will be sufficient to moderate the light by the blinds and curtains. Under such circumstances, a blue, green, or gray tint of the walls of the room best suits the eyes. Bright-coloured objects should be removed from the room.

Injuries of the Eye.

When a foreign body has got into the eye, prolonged attempts to remove it by an incompetent person should not be permitted; but the patient should forthwith obtain the assistance of a surgeon. In general, the foreign body may be at once discovered and removed with little or no pain.

If the removal is effected soon, the distress is in general relieved, or greatly mitigated. Sometimes a sensation remains as if the body were still in the eye, owing to abrasion of the surface.

Abrasion of the cornea is sometimes produced by a scratch of the finger-nail or by awkward attempts to remove a foreign body, or it is the result of a stroke with a twig or an ear of corn, an accident to which reapers are much exposed. A severe form of inflammation of the eye is often excited by such an abrasion, if the case be neglected.

In passing through a wood, a rebounding twig is apt to strike the eye. Even a slight stroke will sometimes occasion cataract or amaurosis.

Accidents often occur from arrows and other projectiles, with which boys play, striking the eyes. Such games should be prohibited where persons are passing to and fro.

Lime is very fatal to the eye.

After a severe injury of one eye, the other is liable to suffer sooner or later from a slow form of internal inflammation, which is very dangerous to the sight.

This inflammation of the uninjured eye, called sympathetic ophthalmia, having proved hitherto little amenable to treatment, the greatest attention should be paid to every case of injury, however slight apparently at first, in the hope of obviating an attack.

When the injured eye has been irretrievably damaged and is the seat of pain, its removal by an operation is the best guarantee of the safety of the other.

The resulting blemish admits of being concealed by an artificial eye.

Use and Abuse of Eye-waters, Salves, and Warm and Cold Applications to the Eyes.

It is a vulgar error, and a very serious one, to suppose that eye-waters or salves are the appropriate remedy for every disease of the eyes, no matter of what kind. In internal inflammations of the eyes the common irritating eye-waters and salves are both useless and destructive; and this not only by the direct injury inflicted, but as leading to a neglect of the proper general treatment. In the mere superficial inflammations, on the contrary, more good is often effected by means of such applications than by any other kind of remedy.

There are two substances in very common use as ingredients of eye-waters, viz., sugar of lead and lunar caustic, in regard to which a caution is necessary.

A solution of sugar of lead is a popular eye-water, and in certain cases it would be a useful enough application, if it had not the insuperable objection of leaving an opaque white deposit on the surface of the cornea, if abraded. This bad effect may result even from a single application, and cannot be prevented.

A solution of lunar caustic, again, dropped into the eye is, in numerous cases, a most valuable application, and, unlike sugar of lead, is not followed by any bad result if at all judiciously employed. But it often happens, either from carelessness or ignorance, that the application is misused by being persisted in for a long time; the effect of which is, that the white of the eye and the inner surface of the lower eyelid are permanently dyed of a dark olive hue, or actually black, whilst the inflammation, for which the remedy was prescribed, is rendered chronic and incurable.

In applying eye-waters, an eye-glass is not to be recommended. It is best to bathe the eyes simply by means of a bit of soft linen rag, taking care to let the eye-water run into the eyes, and, by moving the eyelids upwards and downwards, to bring it freely into contact with their inner surface.

Patients should not, of their own accord, use any application to their eyes but water. In regard to whether the water should be cold or warm, it is to be observed that, in general, the cases in which cold or rather cool water is best adapted are, certain superficial inflammations, floating muscæ and various irritable states of the eye; whilst, on the contrary, in all internal inflammations of the eyes, &c., warm water is preferable. No general rule, however, can be laid down on the subject; but it may be observed that the feelings of the patient constitute a good guide for the choice. In washing, the eyes ought not to be opened in the water.

Cold Douche Bath.—This consists in a fine stream of cold water allowed to play on the closed eye and neighbouring parts. There are particular douche apparatuses to be had, but an equally efficacious douche may be applied by leaning the face over a basin of cold water, and, with the hand, throwing the water up against the closed eyelids.

CHAPTER IX.

PREVENTION AND MANAGEMENT OF THE DISEASES OF THE EYES LIABLE TO OCCUR AT THE DIFFERENT PERIODS OF LIFE.

Early Infancy, or Period at and from Birth up to Teething.

Ophthalmia of New-born Infants.—Within a few days after birth, though sometimes later, infants are subject to an inflammation of the eyes, attended by great redness and swelling of the eyelids, with discharge of yellow matter.

This disease, if taken in time and properly treated, may be in general completely cured. Left to itself or inefficiently treated, however, it will run on so as to cause material injury, too often total destruction, of the eyes.

Exposure of the infant's eyes, immediately after birth, to light, the heat of the fire, or draughts of air, careless bathing of the eyes, perhaps with the dirty sponge which has been used for washing the body, the direct intrusion into the eyes of the soap used for that purpose, or of the spirits sometimes rubbed over its head, appear to be common exciting causes of the disease. That the disease is also frequently occasioned by inoculation of the eyes with morbid matter during labour there can be no doubt.

The circumstance that a number of cases often come under the notice of the practitioner at the same time, and that a considerable interval will elapse before any new cases present themselves, would appear to show that the occurrence of the disease, like that of epidemics, is in some manner influenced by the weather.

To guard against the disease as far as possible, the eyes of infants immediately after birth should be gently bathed with simple warm water, by means of a bit of soft linen rag, and afterwards carefully dried. The greatest attention should always be paid to protect the eyes from exposure to light, heat, and draughts of air. At the same time, it must be remembered that the air ought not to be confined around the infant's face. Of course, a proper temperature and good ventilation of the apartment is essential. It is necessary to remember that pure air is not to be confounded with cold air or a draught of air.

That an infant is actually affected with the inflammation of the eyes under consideration may be known by the eyelids being red and swollen at their edges, by their being gummed together after sleep, and by the discharge of yellow matter which takes place from between them when they are opened. As soon as these symptoms are discovered medical assistance should be called in. Every hour's delay is fraught with the most imminent danger to the sight.

It is to be kept in mind by those engaged about the infant that the disease is catching—that matter from the infant's eyes accidentally coming into contact with the eyes, even of a grown-up person, is apt to excite in them an equally dangerous and destructive ophthalmia. It is also to be kept in mind that in ill-ventilated apartments infection may be propagated through the air, especially from one infant to another.

Even when the eyes are not materially injured or totally destroyed by the ophthalmia of new-born infants, they are liable to be left in a much debilitated state and very susceptible of future disease.

Not infrequently, when the eyes are sufficiently far recovered to admit of accurate examination, we discover central cataract.

Cataract in Infants and Children.—Whether the central cataract sometimes discovered after the subsidence of the ophthalmia of new-born infants existed at birth or came on during the inflammation cannot always be with certainty determined, for want of previous accurate examination of the eyes at birth. There is, however, no doubt that the infant, at birth, is sometimes affected with cataract, and it is probable that in many of the cases of cataract first noticed in infancy and childhood the opacity had already existed, though in a less degree, at birth.

In an infant congenitally affected with cataract the opacity may be so slight as not to be noticeable to ordinary observation. That there is anything the matter with the sight is first discovered only by the child, as it grows up, holding objects very near to look at them. The defect is accordingly put down as short-sightedness (p. 27). In such a case the surgeon, on examination, discovers a grayish opacity of the lens, either throughout its whole substance or only in its central nucleus, the circumferential part being as yet quite transparent.

Congenital cataract appears to be owing to an original imperfect formation of the crystalline lens; and, as in cases of congenital malformation of other parts of the eye and of other organs, several children of the same parents are sometimes found affected with it.

Though the occurrence of the disease in one child may make us dread lest the children of subsequent births be similarly afflicted, it is quite beyond our power to interpose any special means of prevention.

Of course every attention should be paid to the mother's health during her pregnancy, and her mind should be, as much as possible diverted from brooding over the idea that the infant she is carrying may be also born blind from cataract.

In children affected with lenticular cataract we are sometimes told that the opacity made its appearance after convulsions. In other cases it cannot be traced to any cause.

The only remedy for congenital cataract, as for the cataract which occurs at other periods of life, is an operation.

If the cataract be limited to a small dot or dots of opacity in the middle of the pupil, no operation is immediately called for. When, however, the opacity involves the lens so extensively as to interfere materially with the sight, it is proper to operate.

The period after birth when the operation for the cure of congenital cataract should be had recourse to is before teething commences, or, if that period has been allowed to pass, as soon after teething has been completed as possible.

The reason for the early performance of the operation is this:—As the infant cannot see, its eyes are not fixed on objects, but roll about in a heedless manner. This being allowed to go on, the infant loses command over the eyes, or rather does not acquire command over them; and even if sight be afterwards restored by an operation the power of directing the eyes properly and steadily towards objects may never be fully gained.

It is also to be observed that good sight is more likely to be restored by an early operation. Moreover, the important opportunity of education of and by the sight is secured.

The central nucleus of the lens is sometimes opaque, whilst the circumferential part is transparent.

In such a case and in central capsulo-lenticular cataract materially interfering with the sight the question arises whether, instead of operating on the lens, it would not be better to open a passage to the light through the clear circumferential part of the lens by the operation either of iridectomy or of displacement of the pupil by iridodesis.

Against such a proceeding stands the likelihood of the circumferential part of the lens eventually becoming opaque also, and thus necessitating the removal of the lens in the long run.

On the other hand, the advantage of obviating the necessity of using cataract glasses, which is very great in the case of children, recommends the proceeding, even although it may come to be necessary at a later period of life to have recourse to the operation for cataract in consequence of the extension of the opacity to the circumferential part of the lens.

Congenital Imperfections of the Iris.—A congenital malformation of the eyes which sometimes occurs consists in an incomplete formation of the iris or in its total absence.

The eyes may be in other respects perfectly formed, or they may be the subjects of additional malformations.

In cases of congenital absence of the iris, if cataract does not already coexist, it is very likely to come on sooner or later.

The only thing that can be done for cases of congenital absence of the iris is, when the patient grows up, to wear over the eyes, in the manner of spectacles, arched plates of black horn or the like, having a small aperture or transverse slit in them to see through, analogous to the snow-eyes of the Esquimaux. If the state of vision require it, concave or convex glasses may be fitted into the slits.

Congenital Amaurosis.—It sometimes happens that an infant, though old enough to notice, does not follow a lighted candle or other bright object with its eyes. This is sufficient to raise a suspicion of blindness from amaurosis or defective sensibility of the retina.

The suspicion will probably prove too well founded if the eyeballs are at the same time smaller or larger than natural, or if they have a rolling motion in the sockets.

If, however, the eyes are otherwise healthy looking, and especially if the pupils contract naturally under the influence of the light, the child may, in the course of some months, come to give more and more evident signs of gaining strength of vision, which by the end of the first year may appear perfect.

When the eyes are smaller than natural there is not much hope of good sight, at least, being acquired.

A larger size of the eyes than natural sometimes exists at birth, and is called dropsy of the eyes. The cornea in such cases, besides being unusually large, is opaque or cloudy. There appears to be at the same time defective sensibility of the retina. In a few instances the cornea has, with the growth of the child, become clear, and some degree of vision been acquired.

Congenital amaurosis may be owing to imperfect development, or to disease already affecting the eyes before birth, or to injury of the head of the child in instrumental delivery.

Congenital amaurosis may be complicated with cataract.

Congenital Imperfections of the Eyelids.—Congenital imperfections of the eyelids occur, such as defective power of raising the upper eyelids, a state of matters occasionally met with in several members of the same family.

Children are sometimes born with eyelids grown together at their edges.

Moles or mother's marks of different kinds occasionally occur on the white of the eye or on the eyelids, and require to be particularly attended to by the medical man.

Care of the Eyes of Infants.—The eyes of infants should always be guarded from exposure to strong light. Especial care should be taken not to bring an infant suddenly from the dark into a bright light.

Nursemaids are often seen carrying their infantile charge with the eyes exposed to the full glare of the sun, and that notwithstanding the child may be giving expression, by cries of distress, to the suffering it is undergoing.

The eyes of infants while sleeping should be guarded from flies by gauze curtains to the cradle.

Infancy and Childhood, or Period from the commencement of Teething up to about the Eighth Year.

Phlyctenular Ophthalmia.—From the commencement of teething till about eight years of age children are subject to an inflammation of the eyes usually attended by excessive intolerance of light, so that they cannot look up.

Out of one hundred cases of inflammation of the eyes in children at that time of life, it has been estimated that ninety are of this kind. Now, when we reflect how readily the disease leads to impaired sight, how obstinate it is, and how prone to relapse, the importance of palliative and preventive measures may be conceived, especially as much may be done to mitigate its attacks, if not ward them off altogether.

In children affected with this ophthalmia there is usually a disordered state of the general health. The digestive organs and skin especially are found out of order. Besides the inflammation of the eyes, there may be eruptions about the head, sore ears, running from the nose, &c.

The disordered state of general health, of which the inflammation of the eyes under consideration is so often an accompaniment, is much dependent on an original delicacy of constitution of the child, but to a very great degree also on the diet, regimen, and weather.

Want of mother's milk during infancy, improper diet afterwards, impure air, insufficient clothing, are some of the predisposing causes of the complaint, whilst our variable climate powerfully aids their operation. We see the effect of the weather in the rapid changes this ophthalmia undergoes when it suddenly becomes either cold or wet, or dry and warm; all the symptoms being aggravated in the first case and ameliorated in the latter.

The first attack of the disease often comes on from the irritation of teething, after the measles, from cold, &c.

The preservation of the general health, as far as possible, by simple nourishing diet and comfortable clothing (flannel next the skin), tepid or cold bathing, friction of the skin, well-ventilated and moderately lighted nursery (the best-ventilated room in the house should be selected for the nursery), and regular exercise in the open air, constitutes the most important preventive of this ophthalmia.

When the disease has once occurred, and there is a great tendency to relapse, removal from town to country, or to a more sheltered situation, or even to a milder climate, will often be advantageous.

An actual attack of the disease should be most carefully attended to, as neglect is very apt to lead to great injury of the eye and sight. The room in which the patient is ought not to be too much darkened, and the eyes ought not to be bound up so as to exclude both air and light. The blinds of the windows should be gray or dull green.

Every new attack renders the eyes useless for a long time at least, breaking up the health still further, and spoiling the temper of the child, to say nothing of interrupting the education.

Blear Eyes.—This is the result of an inflammation, chiefly affecting the inside and edges of the eyelids, which has suffered frequent relapses, or never been properly treated.

The inflammation originates under circumstances somewhat similar to those under which phlyctenular ophthalmia arises, and requires to be guarded against by similar means.

Care and management of the Eyes during Childhood. —Children should not be permitted to sit up late, nor to fatigue the eyes by much reading, drawing, sewing, or the like, by candlelight.

They should be accustomed to rise early, but only after a good long night's rest.

Even when the eyes are impatient of light, the child ought not to be confined to a dark room, nor forbidden to go out in fine weather. When the child does go out the eyes should be protected from the light by a bonnet-front shade.

It is at this period that attention is often for the first time, or at least more particularly, drawn to congenital defects of sight. Defective sight from congenital cataract in a less degree, for example, which may have hitherto remained undetected, is now often taken by the friends of the child for short-sightedness.

Youth and Adolescence.

Inflammation of the Cornea.—There are two forms of this inflammation; one characterised by great intolerance of light like phlyctenular ophthalmia—the other not so much so, if at all.

The inflammation is still more stubborn and dangerous to the sight.

A particular state of constitution, indicated by, among other appearances, ill-formed and notched upper front teeth, is a common predisposing cause, while the exciting causes are in many respects similar to those indicated in the cases of phlyctenular ophthalmia.

The prevention and general management are therefore, in principle, the same.

Inflammation of the drum of the ear, with deafness, frequently supervenes in the course of this disease of the eyes. The ears ought, therefore, to be well looked to. (See Part II.)

Anterior Internal Ophthalmia.—Iritis, or inflammation of the iris, may be met with at this period of life, sometimes as an extension of the inflammation of the cornea. Depending, for the most part, on the same state of constitution and health, and excited by the same causes, it is to be guarded against by similar means.

Posterior Internal Ophthalmia.—Dimness of sight, in a greater or less degree, is the symptom which generally first seriously attracts attention. Fixed muscæ, photopsy, headache, and intolerance of light, may or may not be precursors or accompaniments.

This form of posterior internal ophthalmia is met with principally in young persons of delicate constitution, more frequently females than males, and is commonly attributable to over-use of the eyes, with neglect of exercise, derangement of the stomach and bowels, disturbed menstruation, &c.

The prognosis is unfavorable; in the more advanced stage, very much so.

Care and management of the Sight in Youth and Adolescence.—It is at this period of life that the eyes come to be used in earnest, and defects of sight, which may have had their source in the earlier periods of life, now more particularly attract attention, or become more fully developed.

In many cases defective sight is, for the first time, occasioned by overwork of the eyes. Excessive use of the sight about this period, if the eyes are at all hypermetropic, is especially apt to bring on asthenopy, that is, inability to maintain the adjustment for near objects, as in reading or sewing, for any length of time (p. 49).

Glasses for short-sightedness are now often for the first time required (p. 27).

Debility of adjustment in the form of far-sightedness is sometimes met with in young persons after recovery from a fever, diphtheria, influenza, &c. Such cases should not be neglected, nor should those occurring under similar circumstances, in which the sight is dim for both near and distant objects, and in which, though the former are seen best, the sight is improved by convex glasses.

Young growing persons, persons at the age of puberty, persons of weakly constitution, are incapable of supporting much exertion of the eyes without injury to the sight.

The eyes of children are sometimes too much tried at school, and the ground is thus laid for future weak-sightedness of different kinds.

The master or mistress too often does not take into sufficient consideration the fact that children have not all equal powers of sight. The near-sighted are forced, perhaps, to hold the book at a distance at which they can see but very indistinctly. Making mistakes which they cannot help under such circumstances, they are chastised for stupidity ; while if they venture to stoop or hold the book near enough for distinct vision, they are punished for disobedience.

If, in order to see more distinctly, the child finds it necessary to bend the head much forwards, or to hold the book, &c., very near, the eyes ought to be examined and the state of sight inquired into.

The mode in which the education should be conducted for the future and the selection of a profession or occupation ought to be in a great measure regulated by the condition of the eyes and power of sight.

He who has *emmetropic* or normal eyes may choose what occupation he likes, but he who is *myopic* (near-sighted), or *hypermetropic* (over-sighted), or *asthenopic* (weak-sighted), or whose eyes are prone to inflame, must accommodate his work to the capacity of his sight.

Myopic persons can see to work on the minutest objects for a long time—*e. g.* can read many pages of fine print even by weak daylight or by the light of a simple candle by holding the object near enough.

A myopic person may, therefore, choose work requiring fine and near sight.

Experience shows that near-sighted eyes, provided the myopy has not reached a high degree in early childhood, and provided they are properly taken care of, bear continuous exertion on fine work very well.

In high and increasing degrees of myopy, on the contrary, the eyes require to be saved from any long-continued exertion on fine work, even with the help of glasses.

A near-sighted person is not fitted to be a sailor or soldier, or for any of the out-door employments of country life.

A person affected with hypermetropy ought not to enter upon a profession requiring continuous exertion of the sight on fine work, for asthenopy will ere long supervene, if symptoms of it have not already manifested themselves, whereas the eyes may stand out well under the employments of a country life.

The employments for which colour-blindness most seriously disqualifies are those of sailor and railway servant, for the colour of a flag or lamp-signal might be mistaken with disastrous results.

A person who has lost the use of an eye ought not to engage in any employment, exercise, or sport, requiring a nice discrimination of the distance and position of objects around him.

Adult Age.

Catarrhal, Rheumatic, and Catarrho-rheumatic Ophthalmia.—Persons of any age, of either sex, and otherwise healthy, may, by exposure to cold, be attacked by a catarrhal ophthalmia, a prominent symptom in which is as if there were some particles of dust in the eyes. An inflammation resembling rheumatism in its accompanying pain and its exacerbations, as also in the constitutional symptoms, inflammatory fever, derangement of digestive organs, and in its causes, predisposing as well as exciting, occurs only in adults, though more rarely than catarrhal ophthalmia, and than another inflammation partaking of the characters of both catarrhal and rheumatic.

Iritis, or Inflammation of the Iris.—The causes of iritis are various; but their effect, if neglected or mistreated, is closure or obstruction of the pupil, whereby, the light being stopped on its way to the retina, sight is prevented. In a large proportion of cases, if not in all, this fatal effect may be obviated by proper and timely treatment. But in numerous cases there is neither timely nor proper treatment. Notwithstanding the pain around the eye which so often attends the disease, the patient not only does not apply for assistance sufficiently early to prevent the obstruction of the pupil, but perhaps uses some irritating eye-water, which only makes matters worse.

The most frequent form of acute iritis is that connected with a rheumatic habit of body.

The common exciting causes are—injuries; over-exertion of the sight, which may act as both predisposing and exciting cause; exposure of the eyes to too strong light and heat; exposure to cold. Both eyes usually become affected.

Relapse is very frequent; but the earlier and more completely the first attack has been subdued, the less liability there is to relapses.

Prevention of relapse.—A person who has once suffered an attack of iritis should carefully guard against sudden transitions from heat to cold, violent exertion, late hours, much reading and writing, and, at the same time, attend strictly to his diet. Sea-bathing is often useful in strengthening the system against the susceptibility. When a person has become liable to relapses, residence in a southern climate during two or three successive winters may be the means of saving him from his dreaded attack and breaking up the tendency.

The operation of iridectomy or excision of a bit of the iris is sometimes had recourse to in the hope of warding off such relapses.

Turn of Life.

Inflammation of the Eyes.—The eyes require still to be guarded against the inflammations above described as occurring in adult age.

Presbyopy and choice of Spectacles.—The turn of life is the time when people most commonly find themselves compelled to have recourse to spectacles on account of presbyopy. (See p. 43.)

Cataract is not of infrequent occurrence.

Amaurosis.—About this time, also, those who have suffered at an earlier period from repeated attacks of ophthalmia, or who have for a long time over-exerted their eyes, are liable to a greater or less degree of impairment of the sight from diminution of the sensibility of the retina.

Care of the Sight at the Turn of Life.—Altogether, the turn of life is a critical time for the sight as well as for the system generally. We ought, therefore, to endeavour to avoid, as much as possible, every unnecessarily prolonged exertion of the eyes in reading or other minute work, especially by artificial light.

Old Age.

Presbyopy and change of Spectacles.—Long-sightedness which commenced about the turn of life is usually found to have increased in old age, requiring spectacles of a higher power. Sometimes not only a pair for reading with, but also a pair for viewing distant objects, is necessary.

Cataract.—Common hard lenticular cataract is now of frequent occurrence. (See "Cataract of Old Persons," p. 61.)

Arthritic or Gouty Ophthalmia.—Persons who become affected with this inflammation of the eyes have often been long subject to derangement of the digestive organs and internal congestions.

The eyes have seldom been previously altogether sound. The person has been subject to a sensation of fulness in the eyeballs, an appearance of sparks of fire before the eyes, and even temporary attacks of blindness, in consequence of stooping, becoming heated, &c.

In persons in the condition of general health, and with the state of eyes just described, ophthalmic inflammation induced by any common occasional cause is prone to assume the form of arthritic posterior internal ophthalmia.

As more special causes, may be mentioned—suppressed gout, anxiety and mental distress, suppression of hæmorrhoids, the suppression of any other habitual discharge, continued over-exertion of the eyes, strong light, cold, excessive use of tobacco, spirit drinking.

Glaucoma and Amaurosis.—At this period, sight is often irremediably lost from glaucoma or green cataract and amaurosis, which perhaps has been coming on gradually for a long time.

Under such circumstances, a sudden attack of gouty inflammation of the eyes destroys the sight in a few days, or even a single night. (See p. 89.)

CHAPTER X.

CARE OF THE EYES IN CERTAIN GENERAL DISEASES, &c.

Care of the Eyes in Measles, Smallpox, Scarlet-fever, Hooping-cough.

The eyes are liable to suffer from inflammation in these diseases, especially the two former.

Although, in general, the ophthalmia subsides with the general disease under very simple treatment, it should be as carefully watched as if it were an independent inflammation. By neglect, very serious or irretrievable injury to the eyes may accrue.

The particular forms of inflammation liable to arise in, or to which a tendency is apt to be left by, measles, scarlet-fever, and hooping-cough, are phlyctenular ophthalmia, the inflammation of the edges of the eye-lids ending in blear eyes, inflammation of the lacrymal passages, with watery eye,—sometimes internal ophthalmia.

In the course of the general disease, the eyes should be protected from strong light, and bathed occasionally with tepid water.

During convalescence, especial care should be taken to guard against exposure to cold.

Variolous ophthalmia, or inflammation of the eyes in smallpox, is generally a much more severe and dangerous inflammation than that occurring in or supervening on the other diseases above mentioned, as used to be exemplified with such lamentable frequency before the general introduction of vaccination. Even yet we occasionally meet with cases of smallpox in which the eyes are destroyed. In smallpox, not only is a tendency left to phlyctenular ophthalmia, blear eyes, disease of the lacrymal passages, &c.; but the eyelashes are often partly lost, and partly turned in against the eyeball.

As a prophylactic measure during the eruptive stage, any matter which collects at the borders of the eyelids, is to be frequently washed away by means of tepid water; and, after each ablution, some mild salve is to be smeared along the borders of the eyelids.

The eyes are not safe even after the smallpox pustules over the body have subsided, and the scabs fallen off. On the contrary, then is the chief danger to the eye, by abscess and destruction of the cornea. This generally occurs about the twelfth day of the eruption, but sometimes as late as five or six weeks after recovery from the primary disease.

In such a case, medical assistance is indispensably necessary.

Care of the Eyes after Fevers.

In great exhaustion, after typhus or yellow fever, abscess of the cornea occasionally occurs.

Amaurosis is not an uncommon effect of fever.

In a fever which has prevailed at different times in Dublin, and which prevailed very extensively in 1843 and 1844 in Edinburgh and Glasgow, an internal inflammation of the eye with amaurotic symptoms frequently supervened. It occurred chiefly in young adults, and its onset was generally traceable to some such exciting cause as exposure to cold, using the eyes too early after recovery from the fever, &c.

Over-work during convalescence from influenza is apt to bring on muscæ volitantes and even amaurosis. Debility of adjustment for near-sight, it has been mentioned, p. 122, sometimes remains after fever, influenza, diphtheria, &c.

Care of the Eyes in Child-bed and Suckling.

A most dangerous inflammation sometimes attacks the eyes in the fever of child-bed; but, considering the grave nature of the principal disease, the affection of the eye constitutes but a comparatively secondary consideration in the case.

Amaurosis is liable to come on after great losses of blood in child-bed.

The eyes and sight are very often much debilitated by prolonged suckling.

Care of the Eyes in Venereal Diseases.

Both gonorrhœa and syphilis are a source of dangerous and often destructive inflammation of the eye.

A most dangerous inflammation of the eye,—one indeed which is often rapidly fatal to the sight,—is a purulent ophthalmia, occasioned by the accidental application of the matter of gonorrhœa to the eye.

The matter may be accidentally applied to the eye of a healthy person through the medium of foul cloths, &c. It is in this way that children are sometimes inoculated.

A person who has suffered from gonorrhœa often remains subject to severe attacks of rheumatism. The eyes, under such circumstances, sometimes suffer from inflammation of the iris, which presents the ordinary character above noticed under the head of iritis. This disease of the eyes is very liable to relapse, and, by neglect or mismanagement, often ends in much impaired or lost sight.

The inflammation of the eyes arising, as a secondary effect, from syphilis, most generally manifests itself as an iritis of a very severe and dangerous character. Inflammation of the choroid and retina are, however, by no means rare.

The constitutional disease appears to be in some cases the exciting as well as the predisposing cause; but in other cases, the inflammation is excited by exposure to cold, over-use of the eyes, &c., which should therefore be avoided as much as possible by a person in a condition rendering him liable to be attacked.

Prevention of the spread of contagious Ophthalmia in barracks, schools, workhouses, &c.

The matter from an eye affected with purulent ophthalmia, if applied to a healthy eye, will excite a similar inflammation. Such a communication by contact has often taken place from the use in common of towels, basins, &c., and so an ophthalmia has spread from one person to another. Without actual contact with matter, contamination of the air, by having matter dissolved in it, is a very common mode of propagation. Thus, when large bodies of people are crowded together, especially in dark, dirty, damp, ill-drained, and ill-ventilated dwellings, contagious ophthalmia is apt to break out. This is the explanation of its propagation in armies, schools, workhouses, prisons, &c. The original cause of this disease was at one time supposed to be a peculiar contagion, first imported into Europe from Egypt (hence the epithet Egyptian), by the English and French armies. It is now, however, pretty generally conceded, that the disease does not depend on any such peculiar contagion, but that it may arise from occasional atmospherical influences, sometimes in isolated cases, sometimes epidemically. There are also local influences which render the disease endemic in many other places besides Egypt.

The disease, in a more or less latent state, is very common among the poorer classes of Irish.

When the disease is prevalent among a number of people necessarily collected together, the healthy should be immediately separated from the diseased, and the eyes of the healthy should be inspected daily. As a person may be affected with the disease in a latent, simply granular state without being aware of it, inspection is the only means of determining whether a person is healthy or not.

Each person ought to have his own towel and a separate portion of water for washing. Every care ought to be taken to keep healthy new comers apart from the affected, and on the other hand to guard against the introduction of a diseased person among the healthy.

By the discharge of diseased soldiers, and their return to private life, the ophthalmia has often been propagated among the lower classes of civilians.

Prejudicial influence on the Sight of the excessive use of Tobacco.

With a disposition to congestion of the eyes, the use of tobacco operates most injuriously on the sight. Defective sight from atrophy of the optic nerve is often found in persons much given to smoking. Persons affected at an earlier age than usual with glaucomatous amaurosis, or that state of the eyes in which inflammation from any occasional cause is apt to assume the gouty character and rapidly destroy sight, I have often found to have been long addicted to an excessive use of tobacco and sometimes spirit-drinking.

When a person does smoke, it should be in a large well-ventilated room, or in the open air and with a long pipe. It should be also when he is resting from work—*not during work.*

APPENDIX.

Adaptation of an Artificial Eye.

An artificial eye is a shell of enamel, representing the front of the eyeball, the loss of which it is intended to conceal. Introduced behind the eyelids, it is fitted by its hollow posterior surface, over the stump-like remains of the eyeball, and received by its margins into the folds formed by the reflection of the conjunctiva from the latter to the eyelids.

When the whole eyeball has been excised, the artificial eye is supported in its place only by its margins being fitted into the folds just mentioned. In this case, it does not admit of such extensive movements as in the former.

Introduction of an artificial eye.—Raise the upper eyelid, and slide the artificial eye, previously dipped in tepid water, up behind it, by the end which is to correspond to the outer corner. Then turning this end towards that corner, and letting the upper eyelid fall, depress the lower, and make the lower edge of the artificial eye slip in behind it.

An artificial eye ought to cause no pain or uneasiness; and to permit the eyelids to close freely and completely over it.

Removal of an artificial eye.—The artificial eye is withdrawn by an opposite procedure, viz., by depressing the lower eyelid, and, with a large pin, or a bit of wire bent like a hook, or even the thumb-nail, hooking the lower edge of the eye out from behind the lower eyelid, whereupon the eye glides out, and falls into the hand ready to receive it. In doing this himself, the patient should lean his face over a soft cushion, or the like, in order that if the eye should slip out of his fingers it may not be broken in the fall.

The artificial eye is taken out on going to bed. Immediately on being withdrawn, it is to be dipped into water, and wiped with a soft lawn handkerchief, in order to cleanse it from the mucus which may be adherent to it. It is then to be wrapped up in a bit of tissue paper, and put by until the morning.

Both before putting in the artificial eye, and after withdrawing it, the person should bathe his eye with water, tepid or cold.

The artificial eye in the course of a year or so becomes rough, from the slow corrosive action of the humours which come into contact with it, and requires to be exchanged for a new one. As it is also liable to be broken by accident, a person using an artificial eye should always have several ready by him.

PART II.

DEFECTS OF HEARING.

CHAPTER I.

NATURE OF THE SENSE OF HEARING AND STRUCTURE OF THE EARS.

Vital Energy of the Auditory Nervous Apparatus.

The sensation peculiar to the auditory nerve is sound, in its various modifications, and the information which the mind can read off therefrom concerning the external objects which, through the medium of the undulations of sound, excite the sensation, regards their vibratile qualities, their distance, position, &c.; but it is to be observed that the mind often attaches itself more to the sounds themselves, as sounds—their conventional meaning, their quality and varied modulations, as in the case of speech and music, awakening ideas in the mind which bear little or not at all on the qualities of the external sounding body.

Structure of the Ear.

The ear is an apparatus specially adapted for the transmission of sonorous undulations. Within its innermost cavities the auditory nerve is expanded in a manner similar to that in which the optic nerve is spread out into the retina in the interior of the eye.

As light is of the sense of vision, so sonorous undulations are the natural excitant of the sense of hearing.

Transmission of Sound to the Auditory Nerve.

The mode in which sound is transmitted to the auditory nerve is this :—The undulations or vibrations communicated by the sounding body to the air falling on the auricle or external ear are by it collected and transferred by reflection to the air in the auditory passage ; by the undulations thus transmitted through the air of the auditory passage, the membrane of the drum is thrown into vibration, and the vibrating membrane on its part communicates a similar state to the air contained in the cavity of the drum.

From this, undulations are propagated through the membrane of the cochlear fenestra of the bony labyrinth to the perilymph, a thin watery fluid, which intervenes between the walls of the labyrinthic cavity, and the membranous labyrinth therein contained. Within the membranous labyrinth is the peripheral expansion of the auditory nerve, together with certain calcareous concretions and a viscid fluid named endolymph ; the membranous labyrinth thus constituted receives from the perilymph surrounding it the sonorous undulations which are communicated from the drum through the cochlear fenestra of the bony labyrinth. The calcareous concretions are supposed to impart to the expansions of the auditory nerve vibratory impulses of greater intensity than a simple liquid, like the endolymph, is considered, by itself alone, calculated to do.

The air referred to as contained in the cavity of the drum, and as being the medium through which the sonorous undulations are propagated from the membrane of the drum to the labyrinth, has its entrance into the cavity of the drum through the Eustachian tube, the passage by which the cavity of the drum communicates with the throat and nose.

Besides air, there is, in the cavity of the drum, a chain of small bones, jointed together and movable on each other by muscles, one end of which is connected with the membrane of the drum, the other with the membrane closing in one of the openings into the labyrinth. This chain of ossicles, with the muscles moving them, appears to serve the purpose of bracing the membrane of the drum and the membranes of the labyrinth, so as to adjust the ear for different degrees of sound.

CHAPTER II.

MANIFESTATIONS OF DISEASE OF THE EARS, AND CARE OF THEM IN GENERAL

Dulness of Hearing or Deafness.

THIS is the most common and constant attendant on diseases of the ear, whatever be their nature in other respects. Very frequently, indeed, the only symptom is dulness of hearing, even when the ear is found by the medical man, on examination, to have undergone material change of structure.

In respect to the degree of impairment of the function of the ear, it is to be observed that the hearing may be very much deteriorated from the natural standard before the patient is aware that he is deaf at all.

If the natural hearing power be estimated at thirty, for example, it may be impaired to twenty without the person being aware of it; but as soon as, by an attack of cold or the like, it becomes reduced to fifteen, then, perhaps, the person discovers that he is deaf.

A disease of the ear may, therefore, be so far advanced as to be beyond a perfect cure, before attention is drawn to the case by the defect of hearing.

The use of Hearing Trumpets.

Hearing trumpets do not aid the hearing in the same admirable manner that spectacles aid the sight. They are of use only to intensify the sound in cases in which the transmitting apparatus of the ear is damaged, or in which the sensibility of the auditory nerve is impaired.

Hearing trumpets thus act merely in a manner analogous to the glasses which, by their magnifying and concentrating power, help the sight somewhat—only somewhat—in cases of opacity of the cornea or incipient cataract, or of imperfect sensibility of the retina.

Whilst, as above seen, scientific discrimination is required to select appropriate glasses for the different qualities of sight, there is no particular principle to guide in the selection of a hearing trumpet. A hearing trumpet must be looked upon merely as a "no better do." That, therefore, which the patient finds by experience, most suitable and convenient to him, he may adopt. The simple flexible tube instrument is that which is found most generally useful.

Ear-ache, and the abuse of Laudanum Drops or other applications of the kind to the Ear for its Relief.

Ear-ache, in almost every instance, is a symptom of acute inflammation of some part of the ear.

In such a case, if laudanum or the like be dropped into the ear, though the pain may be sometimes deadened, the inflammation is not subdued, and material damage to the structure and function of the organ goes on.

There are two principal forms of inflammation in which ear-ache occurs : the one, acute inflammation of the membrane of the drum ; the other, inflammation with the formation of an abscess in the wall of the external passage of the ear near its entrance.

In the first and most important form, the application of a leech or two close behind the ear will relieve the pain, and, until the medical man can be called in, no other application to the ear should be made but drops of warm sweet oil and fomentations of warm water.

In the second form, leeches do not in general afford the same relief, but warm fomentations will soothe and promote the maturation of the abscess. Until this bursts, or is opened by the medical man, complete relief is not obtained.

Itching or a sensation in the ear, short of pain, is owing to some degree of low inflammation of the skin of the passage. The itching induces the person to use an ear-pick, but this only aggravates the inflammation.

The best way to relieve the itching and save the ear from a worse state is to drop in warm sweet oil and foment the ear with warm water; or, if need be, to apply a leech or two behind the ear, until medical advice can be taken on the case.

Discharge from the Ear.

Discharge of matter from the ear, which is always accompanied with greater or less deafness, is a symptom that chronic inflammation is still going on somewhere in the organ or in its neighbourhood.

The complaint is not in every case equally serious, though in all it is serious enough to demand great attention to it.

Acute inflammation, with suppression of the discharge, is liable to supervene from time to time, and may extend to the brain and destroy life.

Exposure to cold, or the improper use of irritating applications to the ear, may be the cause of this serious result.

Accumulation of Wax in the Ears.

The cause of this is not want of cleanliness, but most commonly superficial inflammation of the skin of the passage, implicating the ceruminous glands, such as often results from a cold or repeated colds in the head. In consequence of the inflammation, not only is the wax secreted in increased quantity and vitiated quality, but exfoliation of the scarf-skin of the wall of the auditory passage takes place. This exfoliated scarf-skin is found often to constitute a large part of the bulk of the accumulated mass.

The obstruction of the auditory passage by the plug of wax and exfoliated scarf-skin causes more or less deafness. Besides this the patient may complain of noises, and sometimes of a dull uneasy sensation in the ears with confusion of the head.

In the management of such cases it is not alone sufficient to syringe out the accumulated wax and scarf-skin, but it is necessary to remove the cause of the accumulation by treatment of the inflammation of the skin of the passage.

Though, by the removal of the accumulated wax and scarf-skin, what is considered a cure of the deafness is generally effected, the hearing may be found, on testing it, to be much below the natural standard, showing that the inflammation which gave rise to the accumulation had also somewhat injuriously affected the structure of the ear.

Foreign Body in the Ear.

In a case in which a foreign body has got into the ear, or is alleged to have got in, no time should be lost in calling for medical assistance.

The first thing the surgeon will do will be to make a careful examination of the ear, so as to satisfy himself whether there is really a foreign body in it, and if so the next thing will be to ascertain its nature and position, preparatory to proceeding to remove it.

It is to be remembered that a hasty and ill-planned attempt at removal by a bystander is very likely to force the foreign body more deeply into the passage, thereby rendering its successful removal not only more difficult but also more dangerous.

CHAPTER III.

CARE OF THE EARS AT THE DIFFERENT PERIODS OF LIFE.

Care of the Ears in Early Infancy, or Period at and from Birth up to Teething.

By careless exposure of infants they are liable to catch cold, and, if the ear happens to be naturally delicate, inflammation of the organ is probably excited.

If the inflammation be acute and attended by earache, the infant cries and, perhaps, grasps at the ear. If the inflammation be of a chronic character and without pain, the first manifestation of its existence will probably be the stains on the infant's cap, produced by the discharge of matter from the ear.

Under either circumstance, of course, medical assistance ought to be called in without delay. By neglect the hearing may be seriously and irrecoverably impaired, while the discharge may become habitual.

Care of the Ears in Infancy and Childhood, or Period from the Commencement of Teething up to the Eighth Year.

Under the irritation of teething, the ears, as well as other organs, are very susceptible. Every care, therefore, ought to be taken to guard them from draughts.

In childhood, measles being of common occurrence, the ears are liable to suffer, especially if there be any scrofulous delicacy of constitution.

The same delicacy of constitution predisposes the ears to still greater danger in smallpox, and especially scarlet fever.

During this period of life both eyes and ears are liable to become inflamed at the same time. Sometimes the inflammation alternates between the two organs.

With a predisposition to become thus affected, the general health ought to be especially cared for. Every attention will be required in respect to diet, clothing, and exercise.

Care of the Ears in Youth and Adolescence.

About the end of the preceding period and beginning of this, that peculiar inflammation of the eye above described, p. 121, in the course of which deafness so often comes on, is liable to occur in those predisposed to it by the congenital taint of constitution referred to.

At this period attention is often, for the first time, particularly drawn to the defective state of the hearing, and it is supposed that the deafness has only just come on in consequence of a cold: on inquiry, however, it will be found that the person has had previously occasional attacks of ear-ache, perhaps slight discharge from the ear, and had the state of hearing been sooner closely inquired into, it would have been found in consequence very much below the natural standard. All the share which the said cold had in producing the deafness consisted probably in reducing the hearing a little further, so as to render this already existing defect more felt.

Care of the Ears in Adult Age.

The failure of hearing occurring at this period is often merely the result of disease, the seeds of which had been sown in early life.

Accumulated wax with exfoliated scarf-skin in the passage often occurs as the result of a cold or repeated colds.

Instead of suffering in this manner the ear may be affected with severe deep-seated pain from rheumatic inflammation of the membrane of the drum and adjacent parts. If such an attack be quickly relieved, the hearing may not suffer much impairment; but, if the inflammation is allowed to *wear itself out* the hearing will be materially and irretrievably damaged.

Such an attack is very liable to be brought on in a person subject to rheumatism, by exposure to a draught of air, sitting or sleeping close to or under an open window or the draught of a door, riding in a carriage with the window open or broken.

Exposure generally to cold or other noxious influence operates differently in different persons according as one or other organs be the more delicate one. In one person the eyes may suffer, in another the ears, in a third the chest.

Care of the Ears at the Turn of Life and in Old Age.

With the advance of life the structures of our body tend to lose their suppleness and elasticity and to become rigid. Now, as vibratility of the component structures of the ear is a necessary condition for the performance of the function of hearing, it is no wonder that, with the increasing rigidity of age, a corresponding impairment of the acuteness of hearing should take place, even in the absence of any special disease.

But, in advanced life, the effects of previous disease may also be in operation to aggravate this tendency to impairment of hearing.

In advanced life, moreover, the ears are liable to be affected with gouty inflammation, which causes severe pain while it lasts, and, after it subsides, leaves great deterioration of the hearing.

CHAPTER IV.

CARE OF THE EARS IN CERTAIN GENERAL DISEASES.

Care of the Ears in Measles, Smallpox, and Scarlet-Fever.

The ears as well as the eyes are liable, especially in delicate constitutions, to suffer in the course of or after eruptive diseases, particularly scarlet-fever.

The form under which the disease of the ear presents itself varies in respect to seat and severity in different cases, but discharge of matter from the ear, with greater or less impairment of hearing is a common result. There may be also ear-ache, but this symptom is not so constant.

The ears ought to be as carefully watched as the eyes, not only during the course of the disease but also, and very particularly, during convalescence. The patient ought not to be allowed to look out of the window, or even be near one.

If the ears be the weak organs of the body they will, notwithstanding every care, be very likely to suffer.

Any complaint of ear-ache ought to be at once met by the application of a leech or two and warm fomentations.

Care of the Ears in Fevers.

Deafness not unfrequently comes on in fevers.

In some cases it appears, like the blindness which is liable to occur under similar circumstances, to be owing to the affection of the brain which is so liable to occur; in other cases it is probably the result of internal inflammation of the ear itself.

The deafness is for the most part incurable, and, unfortunately, not much can be done in the way of prevention. Recovery from the fever, even with the loss of hearing, however, is something to be thankful for.

Care of the Ears in Nasal Catarrh or Cold in the Head.

The person not unfrequently has dulness of hearing and noises in the head.

The cause of this appears to be that the catarrhal inflammation has involved the Eustachian tubes or passages from the nostrils to the drum of the ears. As the catarrh goes off these symptoms may subside; sometimes, however, obstruction of the passages to the ears from the nostrils continues. In such a case a forcible expiration with the nose and mouth closed will probably re-establish the passage for the entrance of air through the Eustachian tube into the drum.

In catarrh, as already explained (page 145), accumulation of vitiated wax and exfoliated scarf-skin in the external passages may take place and be the cause of the persistent deafness.

During a catarrh, in which the ears are much affected, the person should take great care of himself generally and not go about until the cold has quite gone off. The affection of the ears is then most likely to prove as transient as the cold itself, otherwise it may not do so.

CHAPTER V.

DEAF-DUMBNESS.

Dumbness is a necessary consequence of deafness which has existed from birth, or which has supervened before the period at which children learn to speak.

As to the cause of deafness in such cases:—Dissection of the ears of deaf and dumb persons has, in some cases, disclosed imperfect development of the organs; in other cases the ears, though apparently originally well-formed, had become the seat of disease at a very early period of life, generally inflammation in measles or scarlet fever; other cases, again, and these are the most common have presented acquired morbid changes in addition to original imperfections. In a few cases there has been no appreciable organic defect, original or acquired.

In the management of the deaf and dumb, a distinction is to be made between the question of eliciting the power of hearing and that of teaching the deaf and dumb to speak. Hitherto not much success has attended the attempts to elicit hearing; but experience has shown that deaf and dumb persons may be taught to speak, or even sometimes to carry on conversation, without the hearing being in the slightest degree elicited or improved. It is by being taught to watch and imitate the motions of the lips, &c. of their instructors, that deaf persons have acquired in some degree the faculty of speech, and, at the same time, the ability to distinguish the words spoken by others.

INDEX.

PAGE
Abrasion of cornea ... 107
Adaptation of an artificial eye ... 135
Adjusting power for distances weakened ... 48, 122
Adjustment of the eye to different distances ... 14, 17
  loss of power of ... 40
  change of the condition of the eye in ... 17
  range of ... 20
Adolescence and youth, care and management of the sight in ... 121
Adult age, preservation of the sight in ... 124
Affections, amaurotic ... 74, 83
Amaurosis ... 88
  congenital ... 116
  and glaucoma in old age ... 128
Amaurotic affections ... 74, 83
Anterior internal ophthalmia in adolescents ... 121
Application of eye-waters ... 108
Applications, warm and cold, to eyes ... 109
Aqueous humour ... 7
  anterior and posterior chambers of ... 8
Arthritic or gouty ophthalmia in old age ... 127
Artificial eye, adaptation of an ... 135
Artificial light ... 100

PAGE
Asthenopy, or weak-sightedness 49
Astigmatism, or cylindrical eye 54
Auditory nerve, transmission of sound to 140
  nervous apparatus, vital energy of the ... 139

Blear eyes 120
Blindness, night 86
Blood, loss of, injurious to the sight 131
Blow on the eye, sensation of light excited by a ... 75

Camera obscura 8, 10
Care of the ears during adult age 149
  childhood 147
  infancy 147
  old age 150
  turn of life 150
  youth and adolescence ... 148
Care of the ears in measles, smallpox, and scarlet-fever ... 151
  in fevers 152
  in nasal catarrh, or cold in the head ... 152
Care and management of the eyes during adult age ... 124
  childhood 118
  old age 127
  turn of life 126
  youth and adolescence ... 121
Care of the eyes in measles, smallpox, scarlet-fever, hooping-cough 129
  after fevers 130
  in childbed and suckling 131
  in venereal diseases 131
  myopy 33
  hypermetropy 40
  the incipient presbyopy of emmetropic persons 43
  early infancy 112, 117
Cataract 59
  can it be cured without an operation ? ... 68

PAGE
Cataract, congenital ... 60, 113
division of ... 66
extraction of ... 63
-glasses ... 57, 68
in infants ... 60, 113
lenticular ... 60
hard, of old persons ... 61
in old age ... 60
secondary ... 67
soft ... 60, 66
of young people ... 66
Catarrhal, rheumatic, and catarrho-rheumatic ophthalmia 124
Catarrho-rheumatic ophthalmia ... 124
Chambers of aqueous humours ... 8
Child-bed, preservation of eyes in ... 131
Childhood, care and management of eyes during ... 118
Choice of light ... 98
of glasses for hypermetropic eyes ... 37
for near sighted eyes ... 29
for presbyopic emmetropic eyes ... 43
Choroid coat ... 5
Chroopsy ... 74
Ciliary body ... 5
Cold applications to eyes ... 109
water to the eyes ... 109
Colour-blindness ... 84
defective perception of ... 84
Colours, complementary ... 78
Complementary colours ... 78
Concave glasses ... 28, 30, 56
choice of ... 29
Congenital amaurosis ... 116
cataract ... 60, 113
imperfections of the eyelids ... 117
of the iris ... 116
Conical cornea ... 54
Contagious ophthalmia, prevention of spread of ... 132

PAGE
Convergent glasses, refraction by ... 14
Convex glasses ... 44, 51, 56
Copying trying to the eyes ... 104
Cornea ... 5
  abrasion of ... 107
  conical ... 54
  inflammation of ... 121
Corresponding parts of the two retinæ ... 92
Crystalline lens ... 7
Cure of cataract without an operation? ... 68
Curvatures of refractive media of the eye ... 12
  of retina ... 12
Cylindrical eye ... 54
  lenses ... 57

Daltonism ... 84
Daylight ... 98
Deaf-dumbness ... 154
Deafness ... 142
Defective perception of colour ... 84
Differences in the length of sight of different persons ... 17
Different distances, adjustment of the eye to ... 14, 17
Dilatation, fixed, of the pupil ... 47
Dioptric apparatus of eye ... 7
Diplopy, or double vision with two eyes ... 93
Discharge from the ear ... 144
Distinct vision ... 16
Division of cataract ... 66
Double vision with two eyes ... 93
Dulness of hearing ... 142

Ear, accumulation of wax in ... 145
  discharge from ... 14
  foreign body in ... 146
  structure of ... 139
Ear-ache... ... 143
Ears, care of, in measles, smallpox, and scarlet-fever ... 151
  in fevers ... 15

PAGE
Early infancy, care of the sight in 111, 117
Ears, care of in nasal catarrh, or cold in the head ... 152
Ears, care of during adult age 149
childhood 147
infancy 147
old age 150
turn of life 150
youth and adolescence 148
Egyptian ophthalmia 133
prevention of the spread of ... 132
Emmetropy or standard-sightedness 18, 41
Emmetropic, or standard-sighted eyes 18
Energy, vital, of the auditory nervous apparatus ... 139
optic nervous apparatus 3
Externality or outness, perception of 3
Extraction of the cataract 63
treatment after 64
Eye, artificial, adaptation of an 135
adjustment of, to different distances ... 14, 17
cylindrical 54
Eyes, applications to 108
blear 120
during childhood, care and management of ... 118
foreign particles in 107
of infants, protection of 117
inflammation of 105
injuries of 107
care of, in child-bed and suckling 131
after fevers 130
in measles, smallpox, scarlet-fever, and hooping-cough 129
in venereal diseases 131
Eyeball, a camera obscura 4, 10
structure of 4
Eyeballs, paralysis of muscles of 94
Eye-glass, single, detrimental to the sight 33
Eyelids, congenital imperfections of 117

PAGE
Eyelids, paralysis of movements of 94
Eye-waters, application of 108
&c., use and abuse of 108

Far-sightedness 41
prevention of 43
Fevers, care of the ears in 152
eyes in 130
Fixed muscæ 71
Flies, appearance like, floating before the sight ... 70
Floating muscæ 70
Focus, principal, of a lens 14
Foreign particles in eyes 107
body in ear 146

Glass, reading 57
Glasses, cataract- 57, 68
concave, choice of 29, 56
convex 44, 51, 56
cylindrical 57
prismatic 58
selection of appropriate 14
Glaucoma 89, 128
and amaurosis in old age 89, 128
Gouty ophthalmia in old age 127

Half-vision, transient 85
Hearing trumpets, use of 143
dulness of 142
phantasms of 80
Hemiopy, transient 85
Hooping-cough, care of the eyes in 129
Humour, aqueous 7
vitreous 7
Hypermetropic, or over-sighted eyes 19
Hypermetropy, or over-sightedness 34

PAGE
Identical parts of the two retinæ 92
Images, projection of 8, 10
Imperfections of the eyelids, congenital 117
of the iris, congenital 116
Incapacity to keep the eyes fixed on near objects 49, 51
Inflammation of the cornea 121
of eyes 104, 129, 131
causes and prevention of ... 104, 105
of the iris 121, 125
prevention of relapse of ... 126
Infancy and childhood, care of the sight in 118
ears in 147
Infants, cataract in 60, 66, 113
protection of eyes of 117
Injuries of eyes 107
Iridectomy 90, 126
prevention of relapse of iritis by 126
treatment of glaucoma, &c., by 90
Iris 6
congenital imperfections of 116
inflammation of 121, 125
prevention of relapse of 126
Iritis, or inflammation of the iris 121, 125
prevention of relapse of 126

Lens, crystalline 7
principal focus of a 14
Lenses, concave 30, 56
convex 44, 51, 56
cylindrical 57
prismatic 58
Lenticular cataract 60
Letters, test, for ascertaining the degree of distinctness of sight 22
Light, artificial 100
choice of 98
day- 98

PAGE

Light, sensation of, excited by a blow on the eye ... 75
  too weak, injurious 99
Lunar caustic solution, bad effects of careless or ignorant use of 109

Manifold vision with one eye 52
Measles, care of the ears in 151
  eyes in 130
Müller's case of photopsy from a blow on the eye ... 75
Muscæ, fixed 71
  floating 70
  volitantes 70
Muscles of the eye, paralysis of 94
Mydriasis 47
Myopic, or near-sighted eyes 18
  choice of glasses for ... 29
Myopy, or near-sightedness 24
  choice of glasses for ... 29

Near-sightedness 24
  choice of glasses for 29
Nerves, auditory 139
  optic 3, 4
Nervous or amblyopic short-sightedness 27
New-born infants, ophthalmia of 111
Nicolai's case of phantasms 80
Night-blindness 86

Ocular spectra 78
Old age, arthritic or gouty ophthalmia in 127
  common hard lenticular cataract of 61
  glaucoma and amaurosis in 128
  presbyopy and change of spectacles in ... 45
  the sight in 40, 127
  the hearing in 150
Old persons, common lenticular cataract of 61
Operation for cataract, preparation of patient for ... 63

Ophthalmia 105
anterior internal, in adolescents 121
arthritic or gouty, in old age 127
catarrhal 124
catarrho-rheumatic 125
contagious, prevention of spread of ... 132
of new-born infants 111
phlyctenular 118
posterior internal, in adolescents 121
rheumatic 125
Ophthalmoscope, use of 88
Optic nerves 4
nervous apparatus, vital energy of 3
Over-sightedness 34

Parallel rays of light 14
Paralysis of the muscles of the eye 94
of adjustment 47
Perception of externality or outness 3
visual, of the three dimensions of space ... 92
Perfect vision 16
Phantasms 80
Phlyctenular ophthalmia 118
Photopsy 74
Pigment membrane 5
Polyopy, uniocular, or manifold vision with one eye ... 52
Posterior sclerotic staphyloma 25
internal ophthalmia in adolescents 121
Precautions in the employment of the eyes and sight ... 102
Preparation of patient for an operation for cataract ... 63
Presbyopy in the emmetropic eye 41
hypermetropic eye 46
myopic eye 46
with far-sightedness 41
or old-sightedness 40
Prevention of far-sightedness 43
of the spread of contagious ophthalmia ... 132
and management of the diseases of the eyes liable to occur at the different periods of life 111

PAGE
Prevention and management of the diseases of the ears liable to occur at the different periods of life ... 147
Principal focus of a lens 14
Prismatic glasses 58
Projection of images on retina 4, 8, 10
Protection of the eyes of infants 117
Pupil 6
 fixed dilatation of 47

Range of adjustment 20
Rays of light, divergent 14
 parallel 14
Reading in bed injurious 103
 in a carriage injurious 104
 -glass 57
 and writing, use of eyes in 103
Refraction by convergent glasses 14
Refractive media of eye, curvatures of 12
 power of the eye diminished 46
Retina 4, 7
 curvature of 12
 projection of images on 4, 8, 10
Retinæ, corresponding or identical parts of 92
Rheumatic ophthalmia 125

Scarlet-fever, care of the eyes in 129
 of the ears in 151
Sclerotic coat 5
Seasons of the year for operations for cataract ... 63
“Second sight” 82
Secondary cataract 67
Selection of appropriate glasses 14
Sensations of light and colour 74
Shakespeare on phantasms 81
Short-sightedness 24
 choice of glasses for 29
 nervous or amblyopic 27

PAGE

Short-sightedness, a symptom of central cataract 27, 113
Sight, care and management of, in youth and adolescence 121
defects of, requiring spectacles 14
excessive use of tobacco, prejudicial to 134
injured by prolonged suckling, loss of blood, &c. ... 131
management of, in old age 127
precautions in the employment of 102
care of, in adult age 124
at the turn of life 126
in youth and adolescence, care of the 121
of different persons, differences in the length of ... 17
"Sight, second" 82
Single eye-glass detrimental to the sight 33
vision with two eyes 91
Soft cataract 60, 66
Sound, transmission of, to auditory nerve 140
Smallpox, care of the ears in 151
eyes in 129
Spectacles, change of, in old age 45
concave 30, 56
convex 44, 51, 56
prismatic 58
Spectra, ocular 78
Spectral illusions 80, 82
Squinting 95
operation for 96
Staphyloma, posterior sclerotic 25
Stereoscope 92
Strabismus 95
operation for 96
Structure of ear 139
of eyeball 4
Suckling, care of eyes in 131
prolonged, injurious to the sight 131
Sugar of lead solution, a popular eye-water, not to be recommended 109
Sympathetic ophthalmia 108

PAGE

Test letters for ascertaining the degree of distinctness of sight 22, 23
Tobacco, excessive use of, prejudicial to the sight ... 134
Transmission of sound to auditory nerve 140
Treatment after the operation of extracting the cataract 64
Turn of life, amaurosis at the 126
  inflammation of the eye at the 126
  presbyopy and choice of spectacles at the 40, 43
  care of the eyes at the 126
    ears at the 150
Two eyes, double vision with 93
  single vision with 91

Unequal power of the two eyes 52
Uniocular polyopy 52

Venereal diseases, care of eyes in 131
Vision, phantasms of 80
  distinct 16
  manifold, with one eye 52
  double, with two eyes 93
  half, transient 85
  perfect 16
  single, with two eyes 91
Visual perception of the three dimensions of space ... 92
  sensations, abnormal excitement of 74
Vital energy of optic nervous apparatus 3
  of the auditory nervous apparatus ... 139
Vitreous humour 7

Warm applications to eyes 109
  water to the eyes 109
Water, cold and warm, to the eyes 109
Wax, accumulation of, in the auditory passage ... 145
Writing and reading, use of eyes in 103

Young people, cataract of 60, 66, 113
Youth and adolescence, care of the ears in 148
  care of the sight in 121

U. HOLZER
BINDER
BOSTON, MASS.